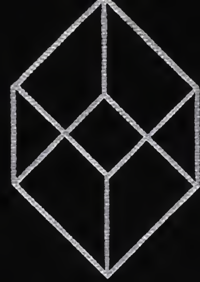
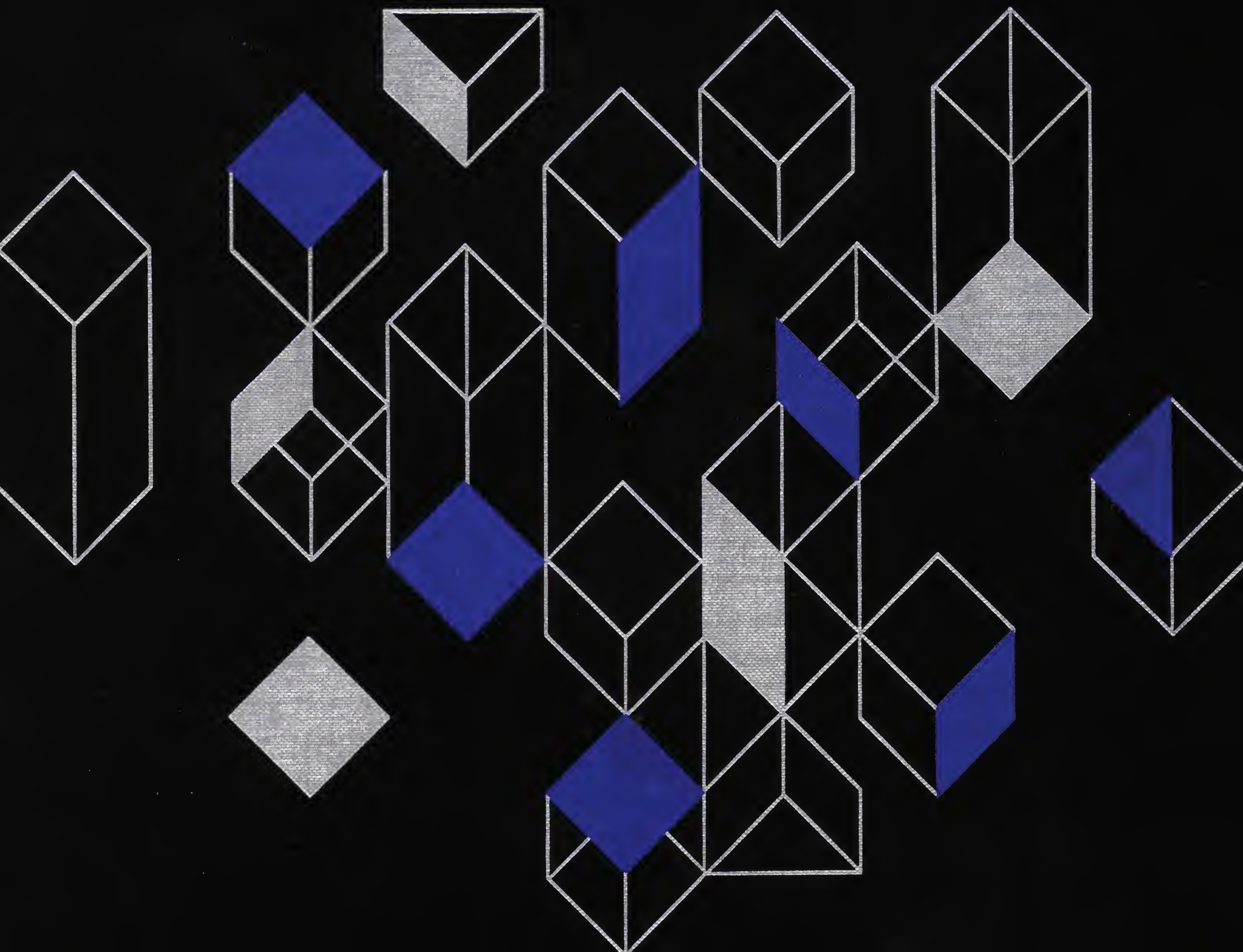


# ALUMINUM IN MODERN ARCHITECTURE *volume I*



# ALUMINUM IN MODERN ARCHITECTURE *Volume I*

by JOHN PETER

Associate Editor, Edward A. Hamilton

Companion to Aluminum in Modern Architecture Volume II—Architectural Engineering

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# REYNOLDS METALS COMPANY

OFFICE OF THE PRESIDENT

RICHMOND, VIRGINIA

To the reader:

Without doubt, every architect and engineer in the building industry today would like to have a preview of the kind of structures men will be erecting ten, twenty, or thirty years from now. In the belief that the record of the immediate past is one dependable guide to the future, Reynolds Metals Company is pleased to present to the building industry one hundred and one outstanding examples of the work of some of the world's greatest architects of today in which they have explored and utilized the many advantages of aluminum.

Here you will find some of the most important structures of our time, none over ten years old, yet with fresh ideas, new approaches, and new beauty that may well prove the key to architectural thinking of the future.

This book is evidence that architects and engineers today are thinking in aluminum instead of designing exclusively in terms of traditional materials. And as the building industry becomes more familiar with the special qualities of aluminum, the years ahead should be a period of great invention -- a period with its own architectural and engineering geniuses -- a period of daring new architectural concepts. Naturally, we look toward this future with the greatest enthusiasm.

November 12, 1956

R.S. Reynolds, Jr.

R.S. Reynolds, Jr.

The editors acknowledge with appreciation the various individuals to whom they have turned for help and information: Douglas Haskell, editor, The Architectural Forum and members of his staff, including: Walter McQuade, Jane Jacobs, Ogden Tanner, H. M. Ottman; Peter Blake, House & Home; as well as, Thomas H. Creighton, managing editor, and Burton H. Holmes, technical editor, Progressive Architecture; Robert E. Fisher, associate editor, Architectural Record; Philip Johnson, Arthur Drexler, the Architectural Department, New York Museum of Modern Art; Paul Weidlinger; Louise Cooper; Stratton O. Hammon; and the various staff members of the Reynolds Metals Company. The editors in addition wish to thank the following organizations: The Architectural Review, The Aluminium Development Association, Great Britain; L'Architecture D'aujourd'hui, Revue de L'Aluminium, France; Domus, Italy; Societe Anonyme pour L'Industrie de L'Aluminium, Switzerland.

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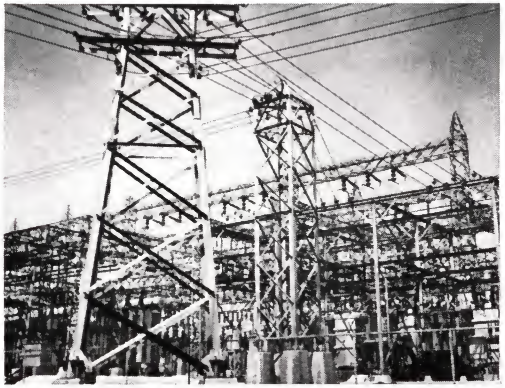
The rapid development of aluminum has been accompanied by superlatives and catch-phrases, most of which happen to be true. Aluminum is "common as dirt" for it is made from aluminum oxides, present in rock and soil almost everywhere, but found in commercial quantities only in limited areas. It is "solid electricity" because of the enormous amounts of electric power required in its refining—about 20,000 kilowatt hours per ton. It is "King of the Lightweights" for in production it far exceeds all

*Bauxite surface mine.*



*Electric power substation.*

*Aluminum pigs.*

the other non-ferrous metals put together and is second only to steel in volume of production throughout the world. Aluminum is also "The Modern Metal" for it is only seventy years since the introduction of the electrolytic reduction process made its commercial production practicable.

Perhaps it is inevitable that such a new material would be considered in terms of existing and familiar ones. Early archi-

*Line of aluminum reduction pots*

ioacchino in Rome (1897), the cornice of the
g, Montreal (1897), to the spire of the German Evangelical Church in Pittsburgh (1927) and cast spandrels of Rockefeller Center, New York (1931), while attesting to aluminum's longevity, are almost indistinguishable from the use of other metals. It is, in fact, only since World War II that the characteristics of the new material have really become articulate in building.

*Church of Gioacchino.*

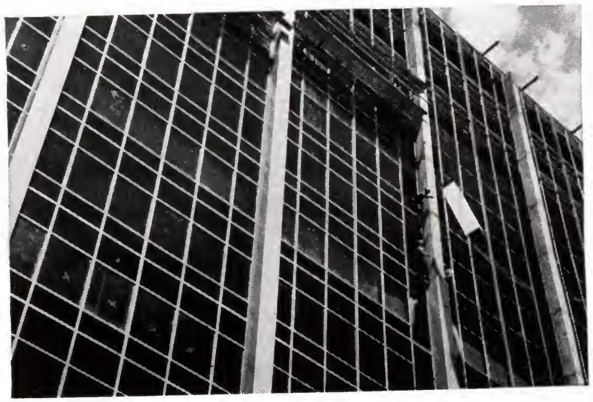
*Canada Life Building.*

*German Evangelical Church.*

*Rockefeller Center.*

The hundred and one projects in this volume have been selected from this post-war period. The perceptive reader will further note that in America, with higher labor costs, the widest use of aluminum has been where maintenance is the dominant factor. In Europe, however, where manpower is cheaper and materials more costly, a good deal more attention has been devoted to the amount of material used. This does not inevitably

*Aluminum structure, Hatfield, England.*



*Aluminum window wall, Dearborn, Michigan.*

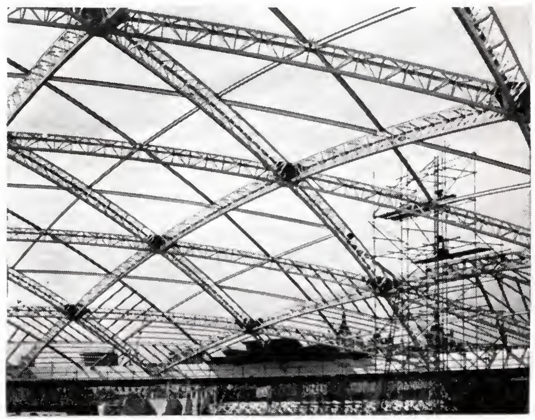
lead to better design but it is the way to better aluminum design. Since this non-ferrous, light metal automatically saves manpower both in erection and maintenance, it is the efficiency with which the material is used that is the measure of its cost.

The engineer who would not think of designing a concrete beam in the same shape as a steel beam has, perhaps because they are both metals, thought of an aluminum beam in the shape of a steel beam . . . and so have many in the industry. Clearly, steel used like concrete would be expensive and disastrous. Aluminum used like steel is expensive if not disastrous. It is aluminum used like aluminum that can lead to many architectural advances in our times.

While this volume does provide incontrovertible evidence of the accelerated acceptance of aluminum as a material of modern

*Concrete structure.*

*Steel structure.*



*Aluminum structure.*

building, it falls so short of demonstrating the full place of aluminum in modern architecture that the editors traveled some twelve thousand miles for the candid opinions of twenty-six leading architects and architectural engineers in the United States regarding its future.

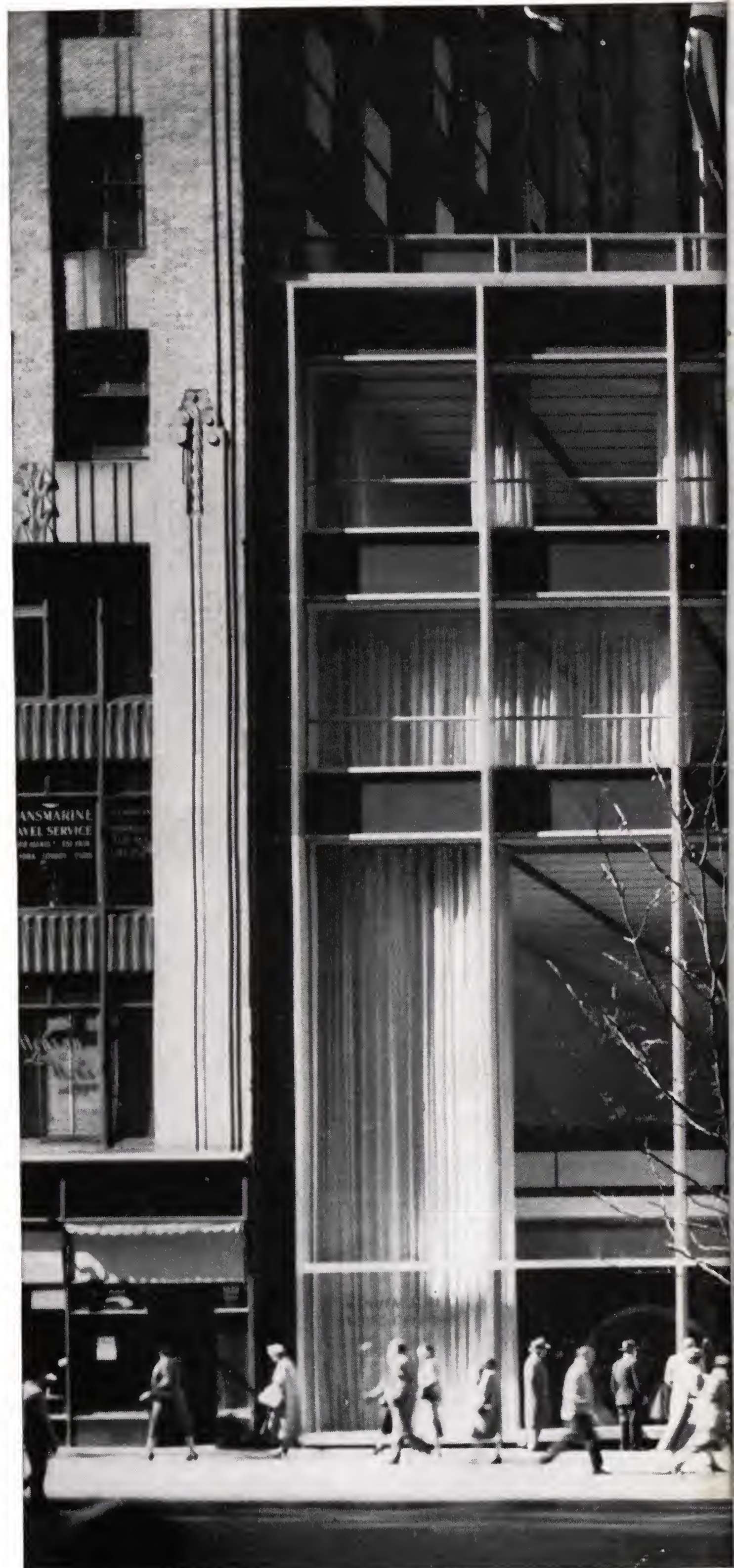
This then is a book of evidence of what has been done recently and opinions of what might soon be. This much can be reported as certain: with aluminum in modern architecture, as with archi-

## MANUFACTURERS TRUST COMPANY

New York, New York 1953

Skidmore, Owings & Merrill

Gordon Bunshaft, *Partner in Charge of Design*




*This is a modern bank with the multi-million-dollar look that is open, friendly, efficient and elegant. Here is a great glistening wall of glass and aluminum; glass in the biggest sheets ever used in a building and polished aluminum mullions that are slim, simple and straight. Together they express a new kind of prestige design.*

If there is doubt any longer whether modern architecture has really arrived one only has to look at the buildings like this that so-called conservative bankers are putting up. This building is in every way a departure from the traditional marble-sheathed bank. It features the biggest show window in town, slabs of clear glass accented by slim aluminum mullions and spandrels of ¼″ dark opaque wire glass. The entire interior is clearly visible to the public. The bank, fully mindful of modern sales techniques, is putting service on display before the public. In addition, even the great vault is on view, spotlighted at night to provide an unusual form of security.

Actually, this wide-open, unshielded interior also points the way toward a new direction in city planning. Gone is the canyon feeling of the street. Just as glazed walls tend to extend interiors, this luminous and spacious interior gives the illusion of opening up the narrow street.

The great glass panels, some as big as 22′ x 9′-8″, are true curtains, actually suspended from the roof, which is cantilevered from the eight interior, supporting columns, like the floors. Aluminum mullions are therefore in tension rather than compression. Because it is situated amidst taller buildings, there is no need for shades, blinds or heat-ray-resistant glass, as little sunlight will ever strike these walls.

*Wall, left, is a true curtain hanging from cantilevers supported by columns set back 19′ from the sidewalk.*

*Luminous ceiling of thin plastic on aluminum grid, upper right, is close approach to perfect illumination, gives bank at night the look of huge crystal lantern.*

*Store-type bank sells service as well as security. The great vault is exposed; escalator is visible and inviting.*

# DUPLAN CORPORATION THROWING MILL

Winston-Salem, North Carolina 1948

Lacy, Atherton, Wilson & Davis

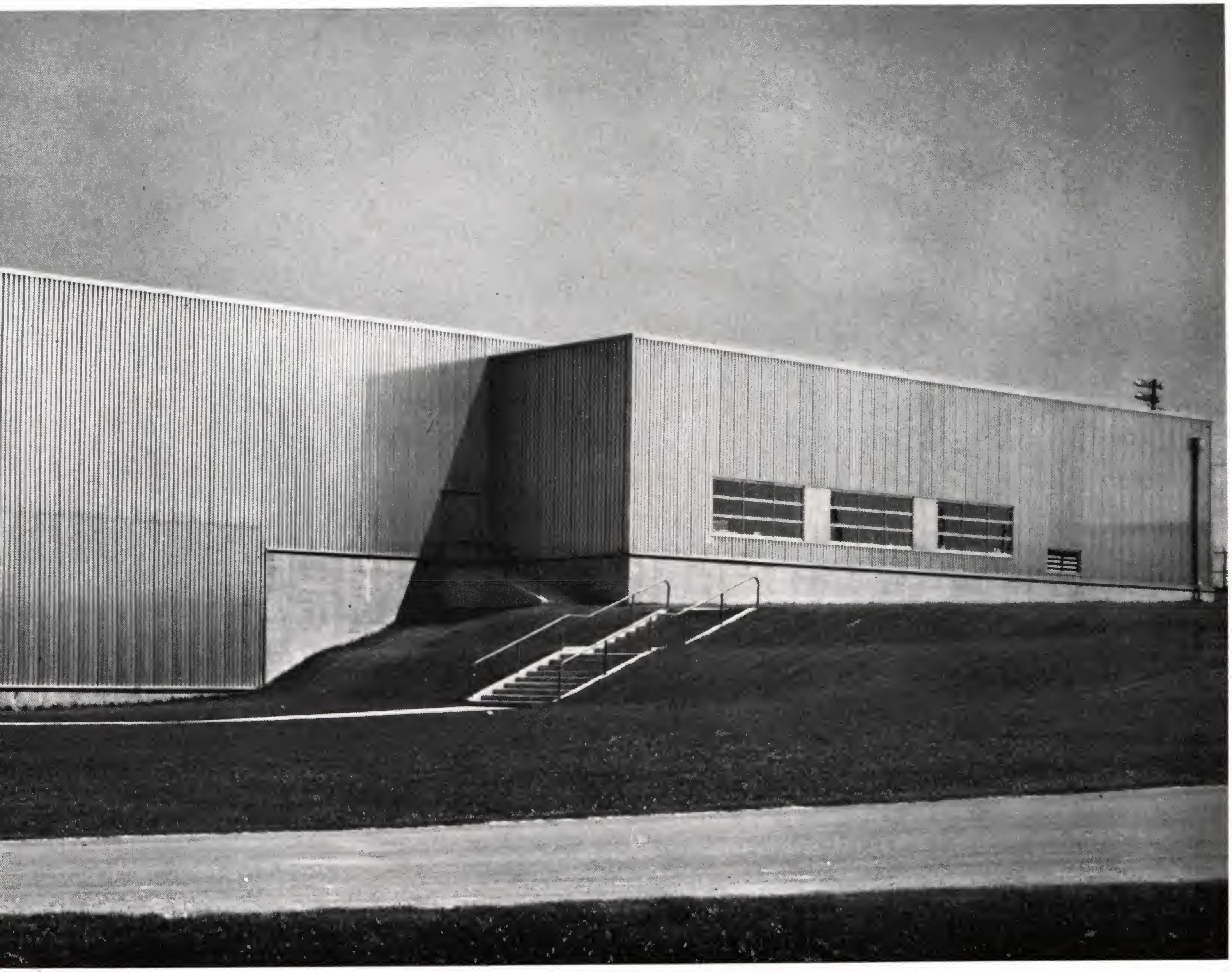
In this textile fiber plant, controlled atmosphere is not simply a matter of comfort. It is literally a part of the machinery, absolutely essential for proper processing of the material. A rigidly controlled high-humidity atmosphere places heavy demands on a wall to avoid both condensation and heat loss.

Factory areas, all on second floor level, are windowless; where windows do occur, they light auxiliary departments. The walls are sheathed in 0.051″ corrugated aluminum to throw back the sun's heat.

Behind the aluminum is a $1\frac{1}{4}''$ air space, then $2''$ of foamed glass insulation, and an $8''$ concrete block wall. The aluminum sheets are carried on aluminum extrusions top and bottom and anchored by angles at intervals between. The fastenings are embedded only about halfway into the block to form a thermal break to prevent heat transmission. The entire wall is closed at the top with an aluminum cap. The architects did not have to worry about expansion joints in the sheathing because the aluminum sheets as a whole are free to expand or contract at will.

The building makes the most of a slope just like a New England barn: raw materials enter the factory at upper ground level. Finished product is conveyed to shipping room at lower ground level.

*Insulated, aluminum-sheathed wall assures precisely controlled, air-conditioned environment in this mill.*



# SOCIÉTÉ MICHELIN HEADQUARTERS

Milan, Italy 1953

E. & E. Soncini

*Panels set back in an open grid frame give an essentially horizontal building an appropriate horizontal appearance with pleasing pattern of light and shadow.*

Michelin, a big French tire manufacturer known best to American tourists for its excellent guidebooks, does its Italian business from this up-to-date headquarters in Milan, a city rapidly becoming as famous for its modern as for its ancient architecture.

One of the most striking features of the office is the straightforward expression of frame construction by a bold rhythm of exposed columns and cantilevered floor slabs. The basic unit, seen between the columns on the exterior, is a room roughly 13′ x 17½′, divisible in half to give two smaller offices with a window each. Just below the aluminum-framed windows, the structural grid is filled in with panels of vertically-patterned anodized aluminum.

Along the first floor is a modern version of the metal fronts with which European shopkeepers button up their stores at night: gates as wide as the column spacing, raised halfway out of sidewalk slots to show their barred upper sections, or all the way (as in photo, left) to give greater protection. The double-width gates at either end protect double driveways through which large trucks enter the interior court behind the office building. The exterior wall is set back from overhanging slabs, giving interiors built-in protection from the summer sun.

*Each bay of the building's skeleton shows clearly on the exterior, and is neatly sub-divided into two full windows and a panel of anodized, patterned aluminum. Floor slabs are carried out beyond the windows as effective sunshade protection for the floor below.*

## WEST COLUMBIA ELEMENTARY SCHOOL

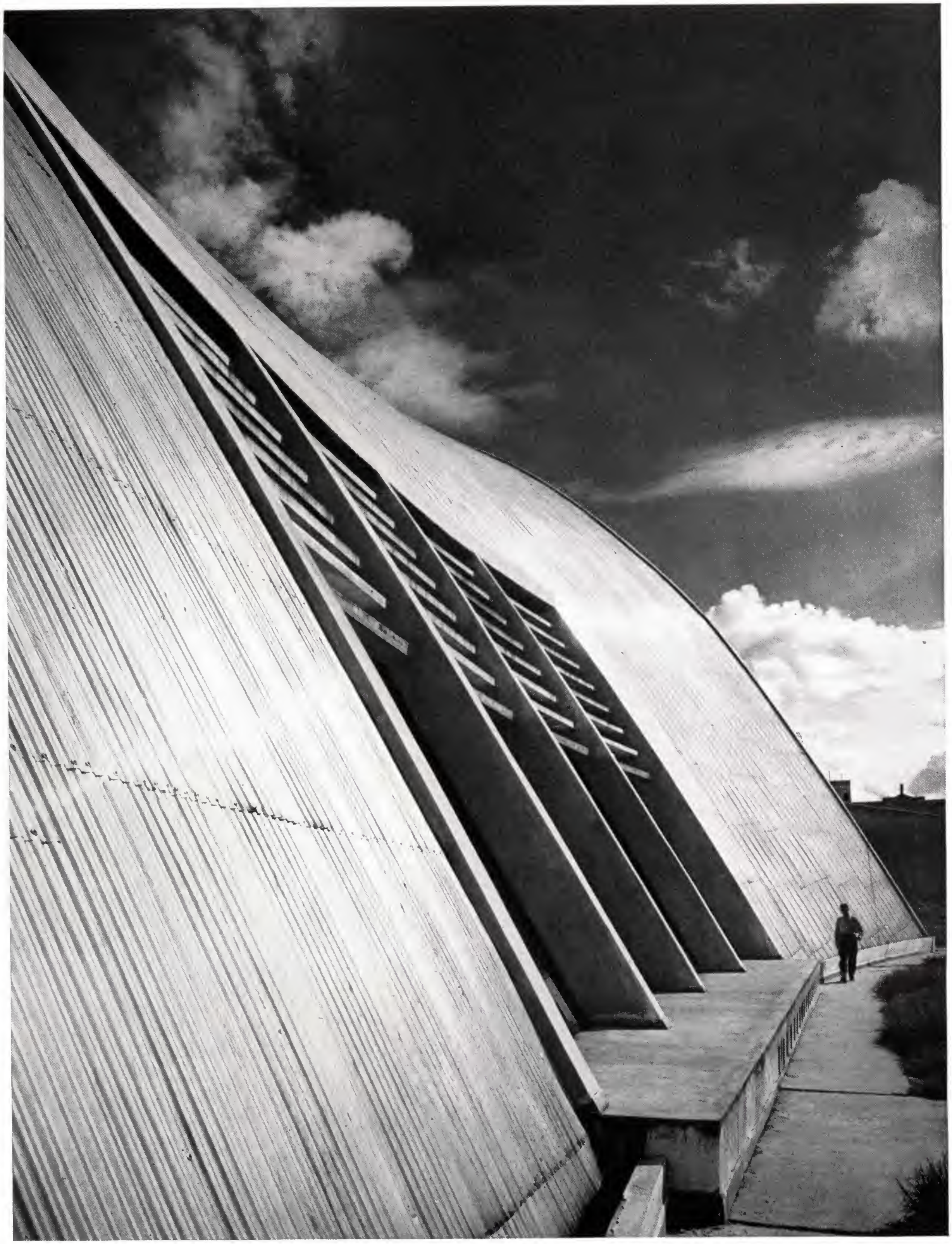
Brazoria County, Texas 1951

Donald Barthelme & Associates

This happy combination of exposed structure and simple materials won for the architect the famed São Paulo Award, but more important to Barthelme, it gives the children of this Texas district a thoroughly delightful school—for less than $10 per sq. ft. Its rows of top-lighted classrooms face, not out toward the hot glare of the flatlands, but in toward landscaped courtyards that make separate corridors and play space unnecessary. Around the exterior there are only narrow vision strips, set in an inexpensive wall of thin white marble panels and aluminum battens. The school's major economy and much of its airy charm come from Barthelme's imaginative use of simple industrial materials on a regular 7′-6″ module: bar joists exposed in lacy patterns, aluminum sash holding floor-to-ceiling glass and tackboard panels, fiber-cement roof decking. Accents of red, yellow and blue found on the wall panels add warmth to the cheerful classroom courts.

*Left: the common room for meals, meetings and plays is at the hub of the plan. It looks out on 60′-wide courtyard that creates a pleasant inner space between the classroom wings. Aluminum is used throughout for the roofing, flashing, window sash and the trim.*

*Gay "roller coaster" shape of concrete loading canopy, top right, offsets the austerity of the school's main façade. Below at the right, deep roof overhangs on the court shade glass walls, serve as corridors between classrooms and as play space during rainy weather.*



# SÃO PAULO PAVILION

Agua Branca Park

São Paulo, Brazil 1953

Icaro De Castro Mello

This great aluminum-sheathed hyperboloid, gleaming in the sub-equatorial sun, encloses an 82′ swimming pool. Until it was sponsored and built by the state of São Paulo, Brazil's ever-popular water sports were interrupted during the cold weather season. At each end of the huge pool there are seating arrangements for 4,500 spectators. Beneath the tiers of seats are 2 stories of dressing rooms, lavatories, showers, a bar and restaurant. Filters and pumps are housed at one end of the pool and the heating plant is located in a small adjoining building.

The amphitheater's hyperboloid shape, chosen for dramatic flair, bears little relation to its structural necessities. Arches forming the hyperboloid are of reinforced concrete joined by pre-molded hollow tiles which are covered with corrugated aluminum skin. In addition to providing effective reflective insulation, the metal surface gives the building an appropriate bright, clean and crisp appearance.

*This aluminum-sheathed pavilion accommodates large-scale international competitions, is self-supporting, parabolic arched structure. Aluminum skin was chosen for advantages of weather-resistance and low maintenance. 19″ space allowed between skin and inner tile surface of parabola relieves heat transmission.*

*Pavilion is located in wooded park with city of São Paulo visible in background, top photo. Interior of pavilion has plastered ceiling with apertures for spotlights and loudspeakers. Pool stretches across the width of pavilion. Beneath the seating arrangement at each end are dressing rooms, a restaurant and lavatories.*

# EQUITABLE SAVINGS & LOAN ASSOCIATION OFFICES

Portland, Oregon 1948

Pietro Belluschi

Since the skyscraper and office building are strictly American building types, Architect Belluschi has contended that brick, tile and stone belong to purely imitative architecture and are simply anachronistic when applied to modern frame structure. Based on his concept, he designed this 12-story building featuring a neat and successful exterior finish of sea-green glass combined with cast and sheet aluminum, applied to a more or less conventional skeleton of reinforced concrete.

Prefabricated aluminum spandrels with lightweight concrete backing, as originally intended, were ruled out because of local code restrictions. Instead, he used a 4″ backing of regular concrete and assembled the cast aluminum components entirely on the site. Due to its lightness, the installation was made quickly and easily from small, movable painters' rigging instead of the usual sidewalk to roof scaffolding. Rolled aluminum facing was applied to the vertical and horizontal structural members.

Maintenance of the exterior glass and aluminum parts is simple. These areas can be washed regularly from a bosun's seat suspended safely from a permanent crane which travels completely around the building along the edge of the roof parapet.

*Left: so precisely detailed that no projection on façade is over ⅛″, the diagrammatic, 12-story frame is without a square inch of masonry surfacing above first floor.*

*Aluminum cover plate and cast spandrels were applied to extruded channels, bolted to concrete frame. Glazing was set in aluminum frames from inside of building.*


PRESCRIPTIONS
TOILETRIES
DRUGS
FOUNTAIN
LUNCH

## CLARK RESIDENCE

Palm Springs, California 1946

Clark & Frey

This low-slung and beautifully sited house is planned as a pavilion in the desert sun. The immediate impression is one of contrast.....visual contrast between the rough-cut beauty of the desert and the super-refined beauty of highly finished materials such as aluminum, glass and steel. Its two-level plan provides three sun decks, reached by easy flights of stairs. Interiors are simply handled, cool shelter. The elevated section, added several years after the ground-level portion, provides a protected area around the outdoor pool.

The architects, much of whose work is in the California desert, favor aluminum in particular for its unusual heat-reflecting qualities. The corrugated aluminum walls and crimped aluminum wind screens also provide sturdy protection against the desert wind. Two surface patterns are used in combination to make an attractive contrast of textures.

*In this trim home on the California desert, the light weight of aluminum walls and roof fascia make it possible to use economical structural supports—tubular aluminum pipe columns. This strong, light construction provides ideal protection against desert wind and sun. The heat reflecting aluminum walls contain an air space for heat drainage. These walls are also finished on the interior with economical asbestos-cement board.*

## S. C. JOHNSON COMPANY

Racine, Wisconsin 1937

Frank Lloyd Wright

*A glass vaulted bridge with gleaming, exterior aluminum ribs connects the executive suite at right with a squash court and garage at left, spanning a recreation terrace. In foreground is a small circular pool on the terrace outside the president's office.*

The world-famed Johnson Wax headquarters were designed, in Wright's words, to be "as inspiring a place to work in as any cathedral was in which to worship." It is also a daring early example of the businessman as a patron of forward-looking architecture. Shown here is a glittering fragment of the company group: a covered bridge that links executive offices atop the main office building with a squash court and observation gallery above the garage. Below the bridge, partially sheltered by the two buildings, is a long terrace for employee recreation, and adjoining this, under the executive penthouse, is an auditorium seating 250 for lectures and entertainment. The buildings, located in an unimpressive city neighborhood, are almost entirely windowless. Breaking the roof and massive curving walls are ribbon clerestories and skylights of glass tubing, such as those used here to daylight the bridge. These tubes, held in place by shiny aluminum ribs and caulked with plastic, make up most of the exterior surface of the newer laboratory tower.

*Long glass tubes set in light curved aluminum frames form a continuous, crisply detailed skylight along full length of footbridge. Glass panels along the sides open up for ventilation and cleaning. At the far end, steps lead down to the glass doors of a squash court gallery.*

# DEARBORN TRANSPORTABLE SCHOOL

Dearborn, Michigan 1953

Eberle M. Smith Associates, Inc.

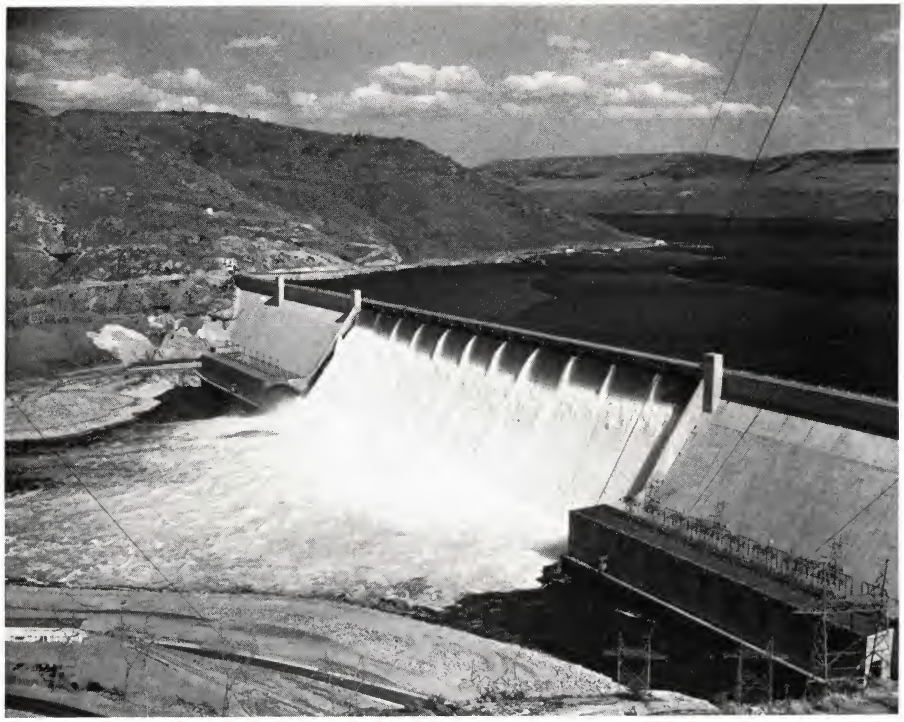
*This picture shows minimal two-vault school unit with entrance doors to classrooms at each end. Other variations have open "corridors" with curved canopy roof running along each side of the building. Exterior wall panels of fluted aluminum are a standard, prefabricated product, that can be dismantled without trouble and transported easily because of their light weight and resistance against shattering and breakage.*

Many school architects in recent years have sought to develop portable schools that could be picked up and moved to follow population shifts as they occur. This Dearborn elementary school is one of the most promising experiments in this field.

For obvious reasons, a portable school must be light. Furthermore, a school that may be dismantled and re-assembled several times during its life-span should be made of a dimensionally stable material—metal. The choice for the walls and partitions in this building was aluminum—ribbed aluminum on the outside, and insulated aluminum panels on the inside. This prefabricated wall-panel system is one of the major advances in prefabrication of recent years. The exterior panels are of rigid sandwich structure with a bonded resin-impregnated kraft paper honeycomb core. Their comparative lightness is impressive: a plywood panel of equal rigidity weighs over six times as much. The interior panels, with extruded aluminum structural members, are only 1¾″ thick and have provision for concealed wiring and convenience outlets. For additional sound-insulation between classrooms, the architects introduced a series of prefabricated storage and utility areas along one wall.

The roof structure uses vaults of plywood over a framework of laminated wood arches supported on pipe columns. The architects developed this school-type as a flexible unit that can be added to in any direction. Result: a school that can grow, shrink or move—an answer to economy-minded school boards concerned with the problem of population shifts.

*Closeup of exterior shows ribbed aluminum panel with embossed texture. Panel facings do not have to be the same on both sides, but may be different gauges, alloys and embossing types. The units are available in standard thicknesses from 1″ to 4″.*



*Stock aluminum bridge rails are used along roadway at the crest of the world's greatest power plant. Coulee, with Bonneville and other nearby hydroelectric projects, makes Washington the largest power-producer of any state in the U. S.*

Grand Coulee, keystone of the burgeoning Northwest, is the largest single structure of man-made materials in the world. Its 10,250,000 cubic yards of concrete, nearly half below the river's surface, hold back a giant reservoir 151 miles long, 127 square miles in area, with a capacity of three trillion gallons. Teamed with a series of smaller dams, reservoirs, canals, siphons and laterals in the $740,000,000 Columbia River Basin Project, it will eventually open up over a million acres of semi-arid land a hundred-odd miles south.

Coulee is also the world's greatest power plant, making possible the Hanford atomic works and the reduction plants that account for almost half the aluminum pig production in the nation.

Some of this metal, appropriately, crowns the dam's 4,173′ causeway in the form of long gleaming rails along each side of the roadway. One of many types of stock aluminum bridge railing sections, they are cool to the touch in hot sun, keep a soft, pleasing sheen without streaking or discoloring. All around the parking area may be seen the graceful, tapered stems of aluminum street lighting standards.

*Nearly a mile in length, sturdy, oval-shaped aluminum bridge rail has light gray hue which blends harmoniously with concrete structure of dam. Where aluminum balusters contact concrete surfaces they are coated with zinc chromate paint which is allowed to dry thoroughly before installation. Aluminum alloys recommended for bridge railings have high strength-weight ratio.*

## GRAND COULEE DAM

Columbia River, Washington 1942

U. S. Bureau of Reclamation

## SIMMS BUILDING

Albuquerque, New Mexico 1954

Flatow & Moore

The outstanding technical advance of the last building decade—curtain wall construction—is here deftly combined with a reinforced concrete structure. Unbroken concrete walls with brick facing enclose the two narrow sides of this office building; a light-weight skin of glass and aluminum opens both the north and south sides of the building.

Massive end slabs of masonry contrast with the glittering curtain wall for a clear-cut design effect that is further enhanced by the way the heavy structural block is lifted above a completely glass-enclosed ground floor.

The concrete floor slabs of the building are cantilevered four feet beyond the exterior columns on the north and south sides. The curtain wall is of prefabricated aluminum spandrels and alternating pivoted and fixed glass windows. The spandrel sections are fabricated from aluminum sheets backed by integral glass fiber insulation, sealed with aluminum foil. The light-weight prefabricated sections and the double-glazed window units are clipped to vertical steel I-beams which are bolted to the concrete floor slabs at 5′ intervals—an inventive technical solution that is every bit as efficient as it looks.

*View at left through entry into lobby shows the airy glass and aluminum sash which encloses the entire ground floor area of this sleek 13-story office building.*

*The neat curtain wall is built of aluminum spandrels with alternating fixed and pivoted glass sections. Projecting beams with clip-on aluminum covers provide rhythmic pattern characteristic of modern style.*

## ROME RAILROAD TERMINAL

Rome, Italy 1950

L. Calini (eng.), E. Montuori, M. Castellazzi,

V. Fadigati, A. Pintonello, A. Vitellozzi

*Bisected by a carefully protected fragment of the ancient Servian wall seen at left in photo, Rome's great and imaginative new railroad terminal is characterized by two major elements: one, a broad sweeping 5-story travertine and marble office building with its simple, horizontal facade jointed by narrow bands of windows, two bands to a story; the other, a vast front pavilion with aluminum and glass walls, houses the waiting room and ticket booths. Its roof structure is a series of massive reinforced concrete S-curved beams, boldly cantilevered 63′ at the front.*

# ROME RAILROAD TERMINAL

In any nation, public building architecture is where significant design achievement should be the rule rather than the exception. Too often, however, it is devitalized by unenlightened officialdom and intrenched architects of state. Such is not the case with the widely-admired Railroad Terminal in Rome.

In 1947 the Italians, with typically high regard for good design, held a national competition for the plan of a new terminal. Two talented groups of architects turned up as winners. Combined, the

*Roof beams' shape reflects curve of ancient ruin seen through aluminum and glass wall of waiting room. Floor finish is pale pink granite slabs.*

winning teams consisted of no less than six architects whose collaboration brought forth a plan that is appropriately grand and surprisingly unified. It consists of a broad, horizontally banded office building of stone that sweeps across in back of the aluminum and glass waiting room and connects on either side with existing wings which were built in the 1930's. In designing the office building, special care was taken to avoid disturbing the ruins of the Agger Serviano. The canopied front waiting room was located off center on the office block for this reason.

The waiting room uses reinforced concrete with a daring in form and function for which Italian engineers have long been noted. Its massive S-Shaped beams vary in thickness from 10′ where resting on columns at front, to 3′ where they join the office building frame. At the front, they cantilever forward 63′. The vast hall is well-lighted by aluminum framed skylights flanking each beam and broad window wall areas with aluminum mullions and trim.

*Interior view at top, the main concourse of building, connecting waiting room and platforms; at right, a dramatic night view of cantilevered, reinforced concrete structural beams. At bottom, entrance doors framed in aluminum, line the full length of front. View from street shows aluminum mullions and glazing at end of main concourse.*

# WYATT OFFICE BUILDING

Washington, D.C. 1954

A. R. Clas

Office buildings with masonry spandrels and metal-faced mullions are standard practice. But this award winning building reverses the order. Limestone faces the mullions and frames the facade as a whole, while extruded aluminum forms the spandrels.

There was reason behind this reversal. The architect wanted to use stone that harmonized with Washington's traditional architecture. But by using aluminum as the principal wall component, and holding the stone to trim, he was able to employ relatively light steel framing. This saved both space and cost. The wall weighs 38 lb. per sq. ft. less than it would, had 3″ limestone been applied over all.

The spandrel extrusions, 5′-6″ high, are 8″ wide; they interlock to form panels up to 7½′ wide. The finish is gunmetal gray. Behind the panels is a 3″ air space, then cinder block. Aluminum window sash, set into aluminum frames, pivots horizontally so that windows can be washed from inside. An extruded aluminum solar shade shields the large display windows to reduce the air-conditioning load.

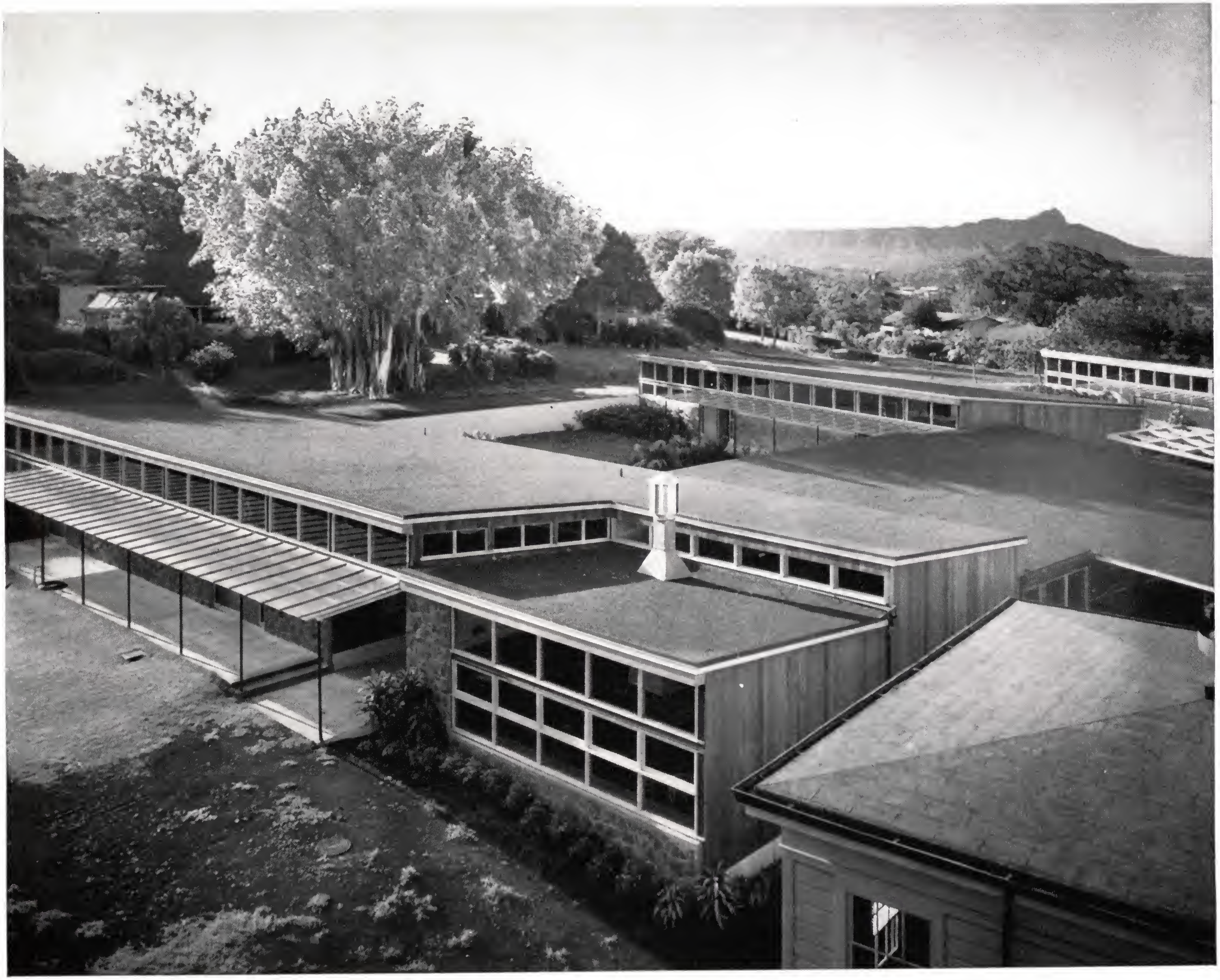
The 12-story office building, recent winner of a Washington architectural award, pleasingly contrasts the crisp solidity of extruded aluminum with the bland solidity of traditional limestone. Note how every detail is sharply defined by a shadow line.

*Each vertical spandrel groove is a separate aluminum extrusion, interlocked with its neighbor at the line of the ridge. Grooves are 1″ deep, yielding a well-defined texture. Since aluminum extrusions could be cut to spandrel height, there are no troublesome horizontal joints. Vertical joints are watertight but permit expansion.*

## PUNAHOU ELEMENTARY SCHOOL

Honolulu, T. H.   1951–55

Vladimir Ossipoff



*The outdoor "corridors" are protected by wireglass canopies set into aluminum framework. The glass admits abundant light and provides shelter during rain.*

*Bilateral lighting in classrooms is achieved through clerestory windows above the level of corridor roof, and through sliding glass walls on far side of classrooms.*

One of the chief problems faced by any architect building in the tropics is to find a simple way of keeping his building cool. One of the favorite solutions is to turn every building into a breezeway, and to let the tradewinds do the air conditioning.

That is exactly what the architect of this Hawaiian school did to ventilate the classrooms. The plan of the school follows the familiar finger-pattern so popular in California. But there is one difference: instead of building-enclosed corridors along one side of each classroom "finger," the architect uses open, covered walks for circulation, so that the classroom areas are protected with canopies of wireglass set into aluminum frames—a detail that lets in abundant light and yet provides all necessary protection against tropical downpours.

On the far side, each classroom has sliding glass walls that open out into a covered lanai and into garden courts beyond. Since the school is designed for elementary grade children, much of the instruction is carried on in these outdoor areas.

The views seen here show the school in its first phase of development; six additional classroom "fingers" will be added as the need for space increases.

## FEDERAL TELECOMMUNICATION LABORATORY

Nutley, New Jersey 1947

Giffels & Vallet, Inc., L. Rossetti

This science-fiction-looking tower was built to permit the research engineers of Federal Telecommunication Laboratories, Inc., an electronics firm, to get 300′ in the air to test short-wave antenna systems. But under the two electronic laboratory floors at the top is a balconied lounge and pleasant restaurant with a kitchen neatly tucked into the tower on the floor level just below.

The entire steel frame and elevator shaft is sheathed in extruded fluted aluminum panels 8″ wide and 20′ high. Aluminum was chosen to do away with maintenance, but floodlights located at the foot of the tower also make the most of its textured metallic surface.

The laboratory and manufacturing buildings at the tower base were among the first structures to use aluminum-faced wall panels. They consist of cellular steel decking, 2′ wide, filled with glass fiber insulation, covered on the exterior with aluminum sheet and clipped at the ends with aluminum extrusions. Sash, too, is aluminum in conformance with the client's determined goal of an up-to-the-minute laboratory building, maintenance-free inside and out.

*Walls of laboratory and manufacturing buildings, left, are aluminum-faced panels, chosen for speed of erection, the labor savings and low maintenance.*

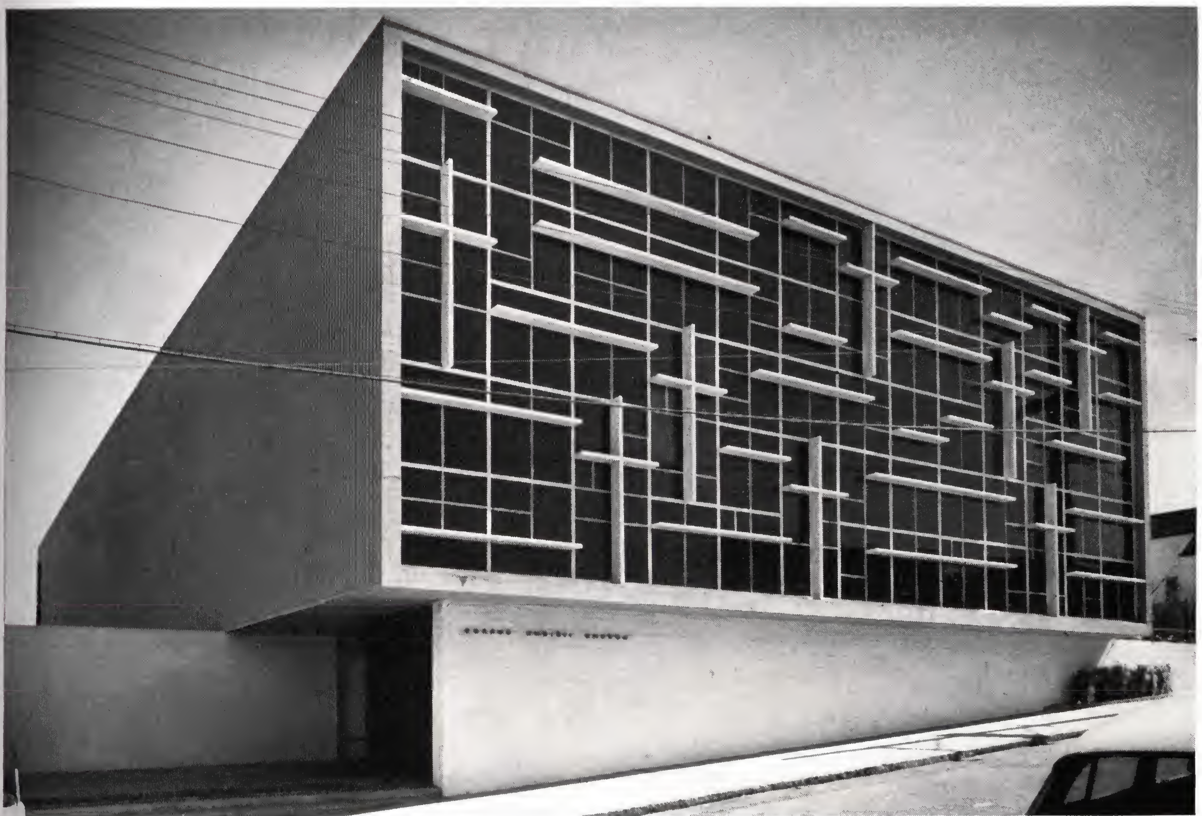
*Laboratory research tower, right, is clad with 8″-wide extruded aluminum panels which lock each other into place. The horizontal joints between panels, occurring every 20′, are calked weather-tight and covered on the inside surface with aluminum closure plates.*

# CORPUS CHRISTI ROMAN CATHOLIC CHURCH

San Francisco, California 1955

Mario J. Ciampi

*Window wall seen from inside church, is a multi-colored pattern of light rays which reflect on the floor and the surrounding walls.*



*Ancient, cherished elements of ecclesiastical architecture—stained glass and metal tracery—take on fresh life in this church window wall of richly colored glass with artistic arrangement of aluminum crosses and horizontals.*

This building is a distinguished example of a revitalizing ecclesiastical architecture. While the careful plotting of this first completed unit in a parish complex merits careful study, it has been the great church wall of aluminum, steel and stained glass that has commanded widespread attention. This colorful window wall forms the full end of the narthex of the building. Framed in terra-cotta colored concrete, the tracery of the mullions, the strong aluminum horizontals and crosses set with panes of rich yellow, blue, green and purple glass, gives an effect at once straightforward and bold. It is a demonstration of the fact that with a fresh approach the emotional substance of older traditional forms, such as stained glass, can be kept, and perhaps even heightened, for the contemporary viewer.

# REPUBLIC NATIONAL BANK

Dallas, Texas 1955

Harrison & Abramovitz

Among the flourishing number of aluminum skin towers, this Dallas Bank building does not claim distinction for uniqueness of individual ideas but it justly deserves, and has received, widespread attention for the skill with which they have been carefully refined and related.

Among its more noted features is an unusually thin curtain wall of 0.125″ thick anodized aluminum panels stamped in a prismatic design backed by 1½″ insulation, vapor sealed with aluminum foil. These lightweight wall sections weigh only 4 lbs. per sq. ft., sharply reducing the total tonnage of structural steel required. They are bolted in place over the spandrels with a 4″ air space between the perimeter heating units and the panels. In order to give rigidity to this exceedingly thin curtain, the architect specified 4″ x 10″ reinforced concrete stiffeners every 4′-5½″ over the exterior surface.

The main banking room is free of interior columns. To accomplish this, the floors above are suspended from huge trusses in the wing's top story. Besides the trusses, this story contains the building's air-conditioning equipment. Basements have generous space for parking and drive-in banking.

*Night view, left, dramatizes the 36 stories and beacon that make the Republic National Bank the tallest building in a state that appreciates size and superlatives.*

*The windows are just 5½′ high to cut air-conditioning load and sky glare. Double glazed and vertically pivoted in aluminum frames, they form a continuous design which permits unusually flexible partitioning.*

## A & M CONSOLIDATED HIGH SCHOOL

College Station, Texas 1955

Caudill, Rowlett, Scott & Associates

With this up-to-the-minute, economically built school, open planning has, at last, successfully invaded the classroom. Located in one long, horizontal structure, the classrooms along one side are divided from the corridor on other side simply by open book shelves. With effective acoustical ceilings the noise problem is not serious, since in southern school buildings, doors and windows are customarily kept open. Between-room partitions and panels

have the admirable asset of portability. They can be moved freely from year to year.

The building's elegant exterior curtain wall consists of floor-to-ceiling aluminum windows combining glazed sections and $\frac{3}{8}''$ asbestos cement panels.

The circular domed auditorium is 115′ in diameter, employs laminated wood arch construction. It proved to be a great deal more economical in cost than the classroom unit by almost $1. per sq. ft.

*Novel and attractive high school with no interior doors is divided into three separate units: circular auditorium, seen left, classroom and lab building, shown below. Wall is aluminum window sections, floor to ceiling, with glazing and filler panels.*

*Bottom view shows interior open planning in operation, with a study group divided from corridor by book shelves. Space dividers throughout are portable or free standing.*

## TECHBUILT HOUSE

Weston, Massachusetts 1954

Carl Koch

*Entrance door, at right, faces split-level stairway—one half flight up to second floor; one half flight down to first. The asphalt shingled roof consists of 4′ x 16′ pre-assembled fir plywood panels pressure-glued to 2 x 4's, insulated with aluminum foil.*

Of the prefab homes that are transforming U. S. residential building from a craft to an industry, none has been more widely acclaimed than this Techbuilt plan, especially for its approach to a fundamental problem of the average American family—the need for housing flexibility.

This house can adjust, expand and contract to suit all the phases of the family life cycle. Its only immovable interior portions are the chimney, stairs, bathroom and four bearing posts. Also to its credit: it is an outstanding housing bargain. Not only does Architect Koch extract the usual savings from pre-stressed plywood panels, factory insulated with aluminum foil, he designs in other novel economy features. First floor sets 3′-6″ below grade, thereby using as a part of its wall the foundation that would have to be dug anyway to get below frost line. What traditionally would be an attic has had 5′ of wall height added at the eaves. The result is a roomy second floor, equal in area to the first floor.

Its ample rooms are well-lighted and ventilated by lightweight transverse aluminum windows. Exterior wall finish is board and batten or wood shingles applied on the site; the interior finish is plasterboard with exposed plywood paneling on the ceiling.

*The plan is a simple rectangle with two full, well-lighted floors which make use of every inch of available space. Partitions are non-load bearing, can be designed in any arrangement to suit the needs of the client from newlywed to retired couple with married children living at home. Upper room at end of house above, can be used as separate sitting room or left unfloored for studio living room beneath. Outdoor stairway, optional, provides easy access to second floor. Window wall is designed with careful, almost oriental detailing of heavy wood and delicate aluminum lines.*

## UNITED NATIONS SECRETARIAT

New York, New York 1950

Wallace Harrison, *Director of Planning*

This great cliff of blue-green glass, towering 39 stories above New York's East River, is one of the most widely known architectural works of the century. A bold monument to the labors of all nationalities toward a peaceful world, it is also a dramatic demonstration of the peculiarly American art of skyscraper building. Its single, thrusting slab and shimmering curtain wall—the "UN Look"—has captured the popular imagination as few modern buildings ever before have done.

The east and west facades, two enormous, 287′-wide mirror-like screens hung outside the building skeleton in a vast marble frame, owe much of their lively sheen and depth of texture to the projecting aluminum tracery that ties together the 5,400 heat-absorbing windows and 5,400 spandrels of tempered wire glass. As the sun moves across this lacy pattern it casts back silver sparks of light towards the observer, deepening shadow lines on the glass behind. Window sash of aluminum is double-hung; aluminum mullions, spaced on 4′ centers, act structurally in taking wind pressure against the glass. Aluminum grille-work bands the mechanical floors at the 6th, 16th, 28th and 39th floor levels and creates an airy screen around the mechanical structure on top.

*Against the packed skyline of Manhattan, the high mass of the Secretariat anchored by the long, low Conference Building and the scalloped shell of the General Assembly, stands as a clear demonstration of the critical importance of site space to modern architecture.*

*Viewed from a mezzanine above the south lobby of the General Assembly Building, the glass and aluminum wall of the Secretariat gleams in the afternoon sun.*

*West wall of building has pattern of insulated aluminum panels along the second story. The long series of large doors form the main trucking entrance to plant.*

This factory is a model in three respects: industrial production planning, amenities for the people who work in it, and consideration for the industrial landscape. It is an enormous building, mostly one story, enclosing a continuous production line a quarter of a mile long. But instead of being a monotonous, dreary blur across the land, it is a clean and handsome oasis in the North Chicago industrial suburbs. And through emphasis of the building components—columns, wall panels and fenestration—the entire vast envelope has been given a rather miraculous human scale.

The portion shown at right is the narrow front end, housing the national headquarters of the company upstairs and the headquarters of the local plant division downstairs. The big checkerboard rectangles of wall are composed of windows alternating with aluminum panels. The 4″ thick panels are formed of ribbed sheet aluminum, front and back, with insulation filler. In addition to their practical advantages, such as low maintenance, and obvious esthetic quality of their crisp texture, they symbolize the cleanliness of plant and product.

*Extruded aluminum window framing is fixed, except for a few vents. Simply detailed stair rail, featuring trim grid pattern, is topped with walnut hand rail.*

*Company's 2-story front office, opposite page, is a handsome checkered design of ribbed aluminum and glass. Whole plant is a model of architectural neatness.*

## UNITED BISCUIT COMPANY FACTORY

Melrose Park, Illinois 1953

Skidmore, Owings & Merrill

# LE PALAIS DES EXPOSITIONS

Lille, France 1951

Paul Herbe & M. L. Gauthier

This fanciful expanse of framework and aluminum sheathing represents one of the biggest facelifting jobs in post-war Europe. The fair building in Lille, Europe's largest exposition hall when it was built in 1934, had its main facade torn away by aerial bombs during World War II.

The engineer of the original building conceived the idea of a new shell over the gaping front, supported by 11 *Vierendeel* trusses set on end. Using these verticals as their starting point, the architects worked out a festive pattern that makes the most of exposed structure. Intermediate verticals and a cross-hatch of platforms join with the giant trusses to form a framework which workmen can easily negotiate to hang temporary signs, special lights and displays heralding the different expositions. Against the silvery-white aluminum panels, the trusses are red, the platforms and entrances are trimmed in blue, making the whole front exterior a most appropriate tricolor theme.

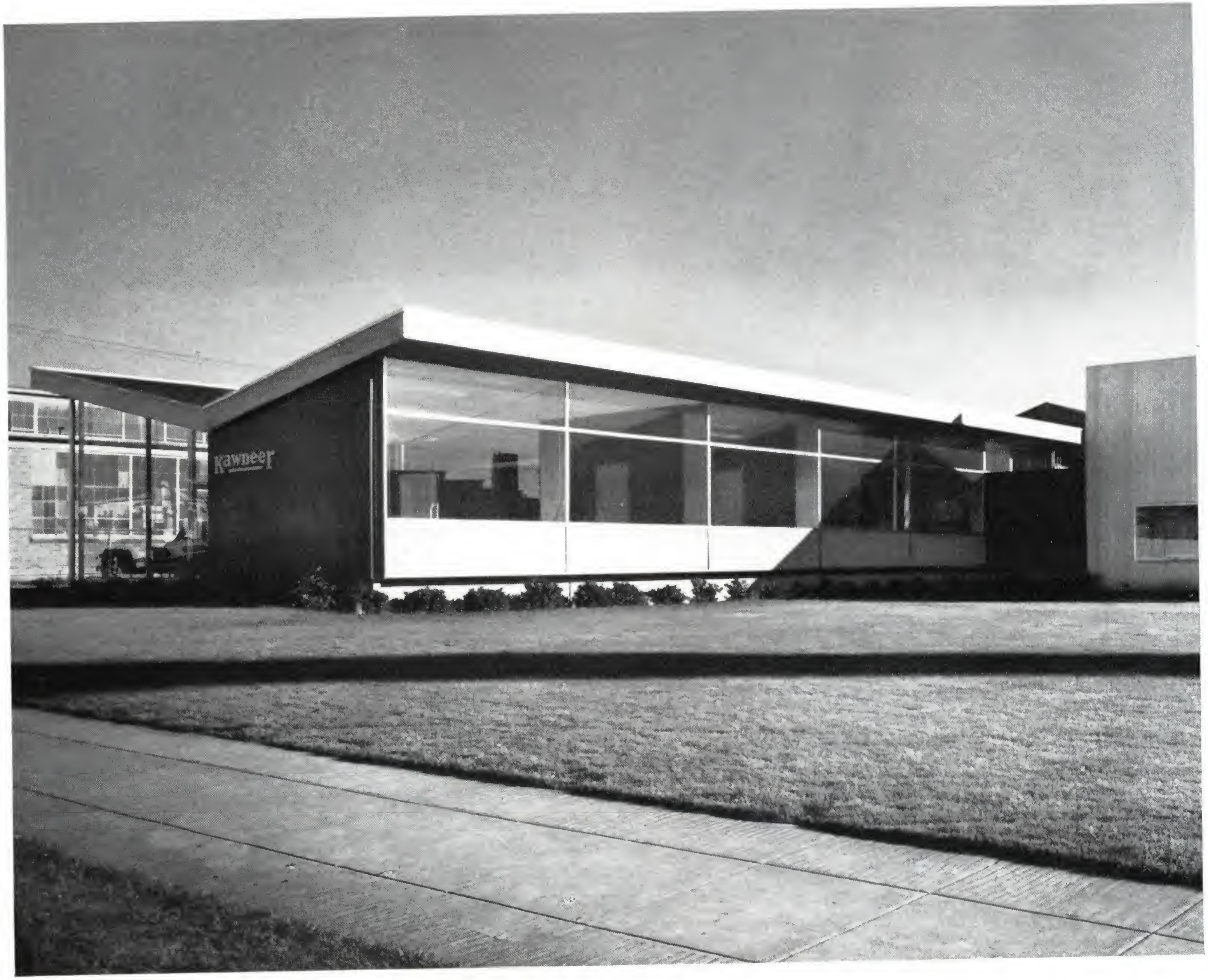
*Remodeled, post-war front of Lille's bombed-out exposition hall suggests the fun of the exhibits inside. The perforated, horizontal and vertical aluminum structure serves as permanent scaffolding for the often-changing sign displays and banners.*

*Metal is used as a decorative tracery in this European example of exhibition architecture. Workmen mounting signs can use perforated verticals as ladders, horizontal stiffeners as platforms. Lightweight aluminum panels were prefabricated in plain, three-light and 12-light patterns, their joints covered by protruding V-shaped sections that cast an effective shadow line.*

## KAWNEER FACTORY OFFICE

Berkeley, California 1948

Ketchum, Gina & Sharp



This satisfying and imaginative solution to a unique problem might well be an object lesson to architects who are seeking new ways for adapting materials to building requirements. The plan of the building had to accomplish two primary purposes: one was to provide efficient offices adjoining an existing factory structure; the other was to incorporate the client's products, which are chiefly storefront units, wherever possible in the building's design. This would make the offices a "silent salesman" of the company's products.

The illustrations on these pages show how well the architects exploited the fresh design possibilities of these previously "typed" aluminum storefront materials, such as glazing mouldings, awnings, hardware, finished wall panels, etc. Standard porcelain-enameled corrugated aluminum sheets in tones of brown and celadon form the building's surface. Overall, the appearance of the surface is a rich warm color with a texture pattern similar to ribbed mahogany. The $\frac{1}{4}''$ plate glass on the window walls is set in fixed aluminum storefront sash; spandrel sections beneath the glass are asbestos panels with vent openings at the bottom.

*Top right, the porcelain-enameled ribbed aluminum sheets are finish on interior walls and flush doors.*

*At left, the sloping roof, framed in wood and steel, is completely supported by concrete-filled pipe columns.*

*Bottom right, lighting by night comes from fluorescent troughs flush with perforated asbestos ceiling panels.*

# PIMLICO HEAT-ACCUMULATOR TOWER

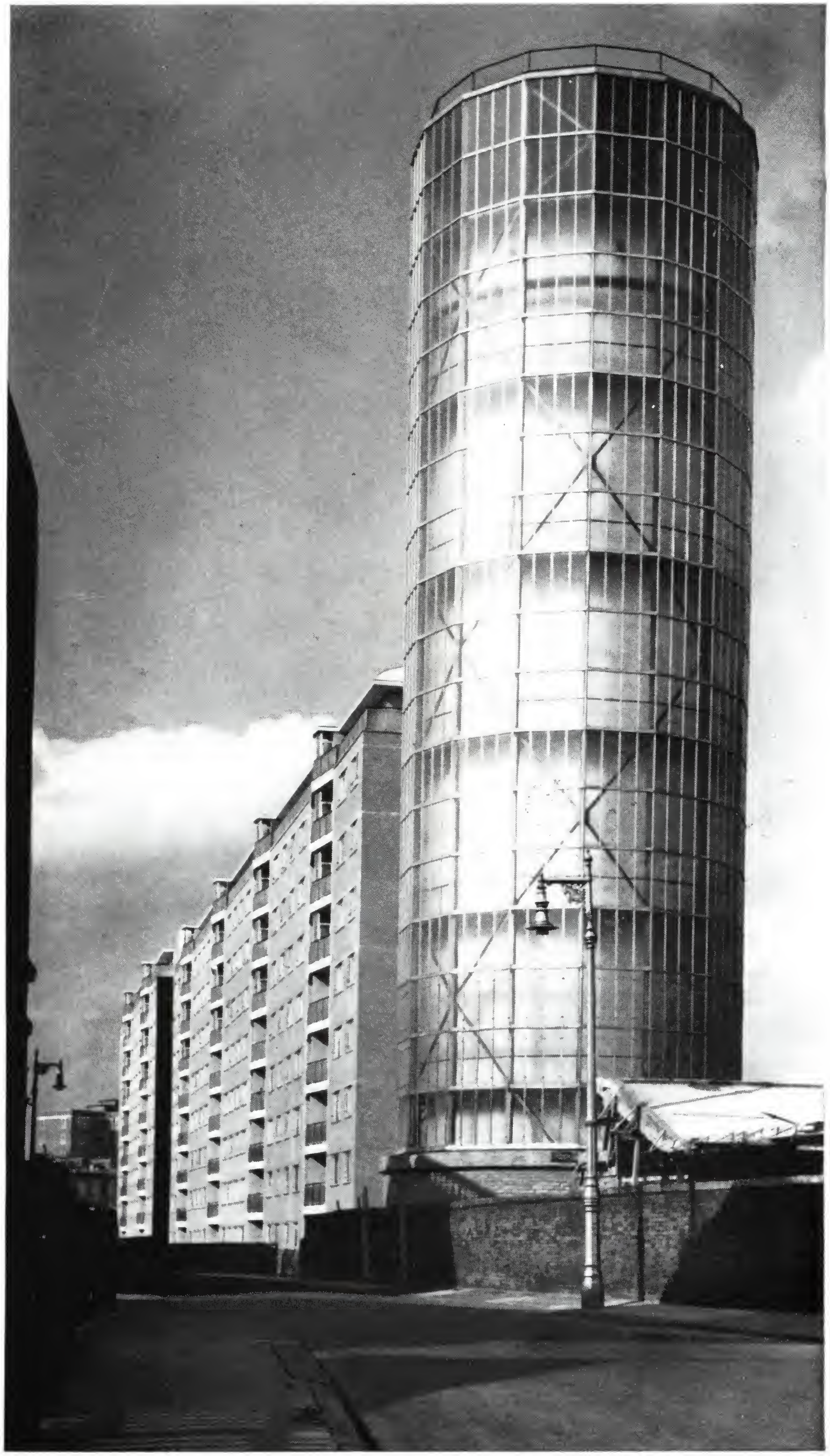
Pimlico, London, England 1951

Powell & Moya

*Tower shows up as bright landmark from opposite side of the Thames. Hot water is piped under the river from power station, foreground.*

*Aluminum glazing frames of the 16-sided tower are electrolytically polished and anodized; glass is removable from inside. Horizontal flashing is of aluminum.*

*Brick apartment buildings, below, feature balcony railings of rough cast glass set in aluminum frames.*



To furnish heat and hot water for this 1600-apartment development the designers erected a giant heat-accumulator tower that utilizes waste heat brought in from Battersea power plant on the other side of the Thames.

The tank is of welded steel, insulated with 3″ of cork; its exterior is ¼″ rough cast glass set in aluminum frames. The steel frame of casing is coated with aluminum paint and the tank's cork surface is plastered and painted. Unlike the traditionally drab, soot-coated steel tanks, the aluminum and glass exterior can easily have its original luster restored by washing from a suspended bosun's seat.

## LAKE SHORE APARTMENTS

Chicago, Illinois 1952

Mies van der Rohe

The glass tower, its basic element three-dimensional space rather than two-dimensional surface, is one of the great revolutionary architectural expressions of our time. And these two apartment towers, rising beside Lake Michigan, are justly among the most famous examples of the form. Using the simplest elements—glass from floors to ceilings marked only by the tracery of floor lines and skeletal window dividers—Mies van der Rohe has created a masterly study of proportion.

A work of art is not necessarily expected to be economical, but this one is; construction cost was an astonishing $10.38 per sq. ft. One economy factor was the fact that each order was doubled since there were two towers. Another was thoroughgoing prefabrication. For instance, the vertical wall dividers were jig-assembled into two-story-high, column-to-column units, welded on the roof and lowered into place. Then the complete aluminum window sections were tilted into place from inside. The aluminum-framed windows beside the concrete columns are subtly narrower than the pair of windows in the center of span to preserve the regularity of the module etched by the dominant black dividers.

*Twin towers, left, are completely walled with aluminum-framed glass; even service areas have etched glass walls. Apartments in the tower at left are 6-room, in the tower at right, 3-room. Aluminum window sections, completely pre-assembled, were tilted into place from inside after jig-assembled wall sections had been lowered into place from roof. Low panes of windows are movable since the building is not air conditioned.*

# DOME OF DISCOVERY

London, England 1951

Ralph Tubbs, Powell & Moya

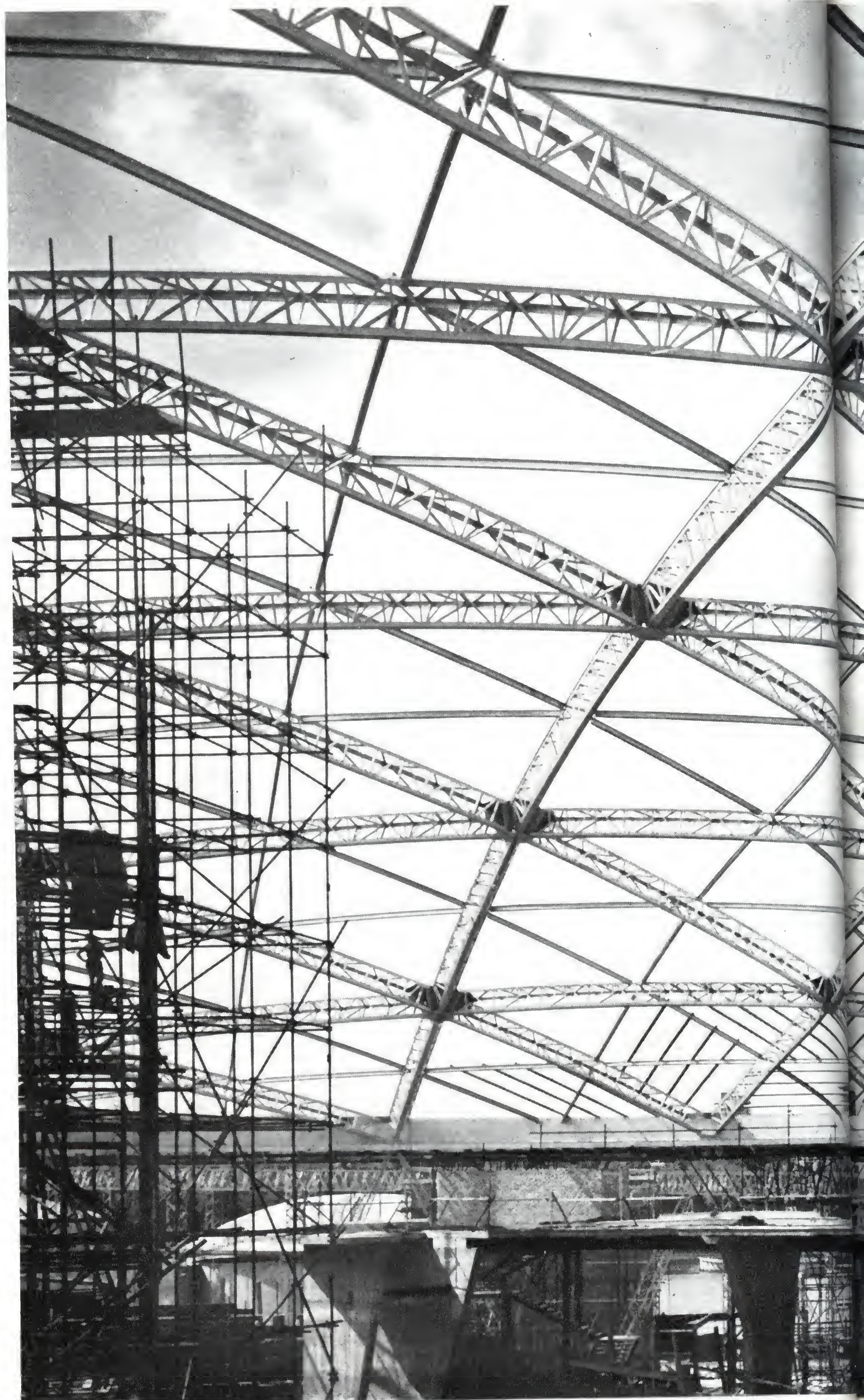
Aluminum has been more widely used for large structural applications in Great Britain than in any other country. British engineers have produced brilliant designs whose ingenuity and precision have brought structural use of this easy-to-erect material to a cost roughly equivalent to that of steel.

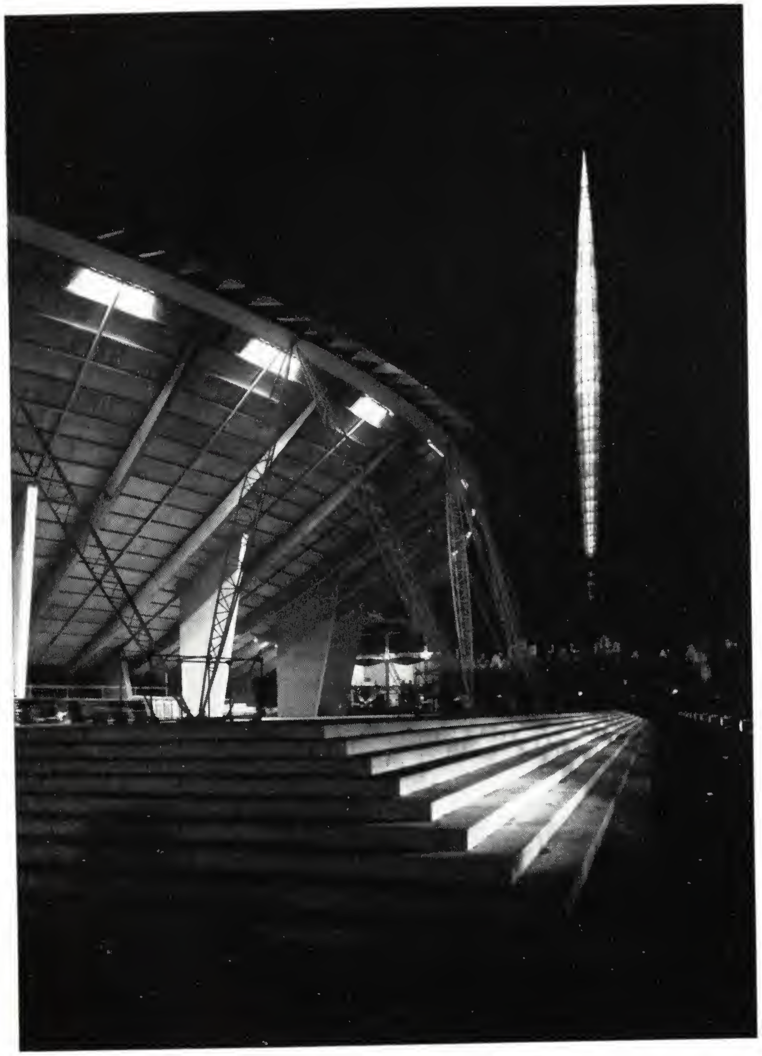
Aluminum is particularly favored by the British for exhibition purposes, and British exhibition design frequently sets the stage for major building advances. The Crystal Palace is a famous example: this glass and steel-cage structure, built in the middle of the nineteenth century, has often been called the first modern building.

The British like aluminum not only for its drama, but because it is easily transported, easily erected, and easily demounted. Its high recovery value is another plus for exhibition use.

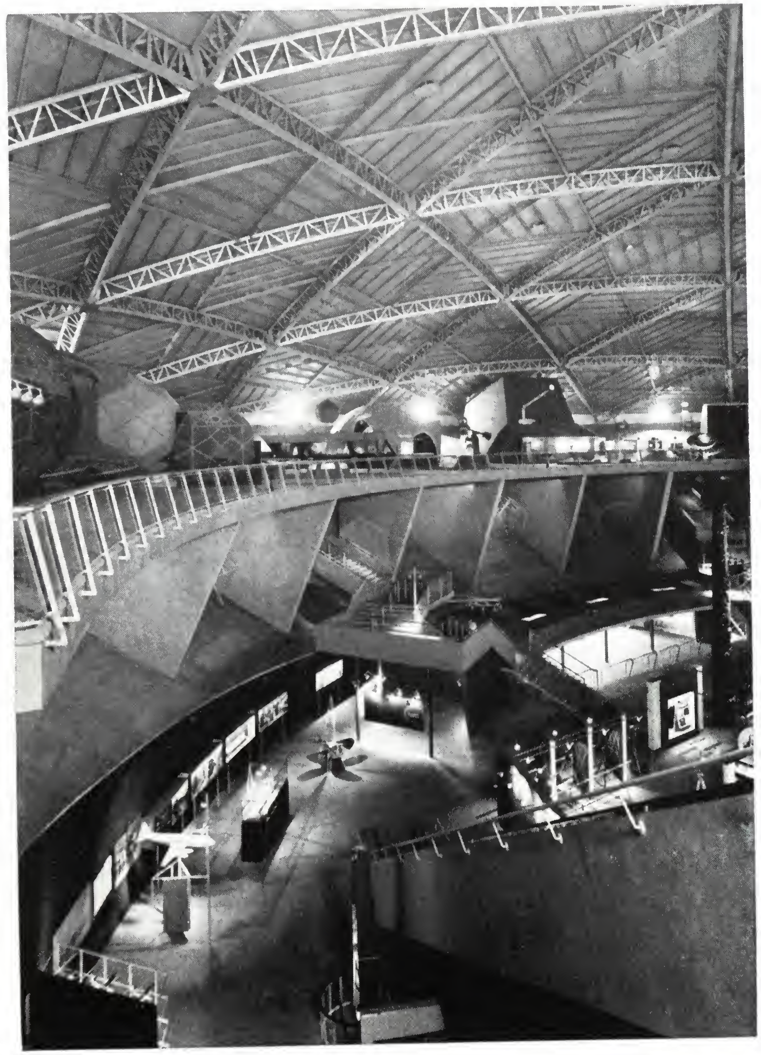
The great Dome of Discovery was built for the South Bank Exhibition, part of the 1951 Festival of Britain. The Dome, 365′ in diameter and 90′ high at the center was, at the time, the largest single structure ever built of aluminum. Except for a steel ring girder with its supporting frame work, this building was constructed entirely of aluminum for an impressively low total weight of only 230 tons.

*The Dome's structural system was based on a series of concentric great circles. Within this scheme, the ribbed arches were laid across in three directions. This created an overall pattern of triangular sections, making it possible to fabricate segments of arches, joists and purlins in standardized curvatures and dimensions.*





*The drama inherent in the high strength-to-weight factor and seeming fragility of aluminum is exploited to the full in design of the Skylon, a most appropriate symbol of the air age. It was suspended in the air between steel cables, like rocket about to take off for outer space.*



*Structure played important part in interior design of Dome. The main aluminum ribs were lattice girders of triangular cross section, curved to radius of 365'. The rib girders were built up from seven extruded sections. It was finally disassembled because of critical need for metal.*

*Aluminum dome seemed to float above deceptively fragile-looking aluminum supports. Its exhibits dramatized exploration of world, universe.*

## 550 BUILDING

Miami, Florida 1951

Robert Law Weed & Associates

This is a professional office building cooperatively built and owned by its tenants—doctors, lawyers, and the architect. The structural system is executed in materials carefully studied for long life and minimum maintenance cost.

Reinforced concrete floor slabs are deeply cantilevered from paired steel columns. A lightweight curtain wall was designed in precast reinforced concrete panels, which were hoisted into place. Horizontal overlapping of these thin slabs provides both a continuous weathertight joint and an interesting visual element in the building facade. Vertical joints between slabs are left open on the face and closed at the back by an aluminum strip snapped into a dovetail joint and then caulked.

A monolithic service shaft at the back of the building not only centralizes mechanical facilities, but also braces the whole structure against wind stresses of hurricane force, making it possible to eliminate deep girders and windbracing at the columns supporting the office floors. To reduce air-conditioning load, window openings were held to a minimum, thoroughly shaded by aluminum louvers.

*Year-round air conditioning strongly influenced design of this office building. Window openings are small and are further protected from solar heat, a major component of air-conditioning load, by aluminum louvers.*

*Fixed vertical aluminum fins are used at western edge of windows in this north wall, above right. Below, the aluminum louvers on east, west and south windows, protect against direct sun heat and are adjustable.*

*Aluminum and glass bridge connects the plant with the storage warehouse across the tracks. The overhead door and hardware at the truck entrance are also of aluminum.*

*Numerous window vents allow for escape of fumes from bubbling vinegar vats. Bar shown at the bottom is protective bumper rail for hand trucks used in plant.*

In its long history, this food processing company has never been one to call four drab walls and a roof a satisfactory building. Upholding this Heinz tradition, they called on one of the nation's top-flight architectural teams to help carry out the company's most widespread plant expansion program. The vinegar plant emerges as the outstanding building unit of the program.

Clad in an aluminum, glass and steel curtain wall, it houses the great distillation vats. Since this is a very specialized process employing only about thirty people, the building requires no fire rating and the wall acts only to resist the weather from outside and the vinegar fumes from within.

It uses a stock, locally-manufactured industrial wall unit, featuring narrow aluminum mullions and aluminum sash with "video" shaped vents. Viewed from the interior, the blue glass wall has the effect of intense white light; from the exterior, it has a muted tone of midnight blue. The simple diagrammatic beauty of the wall is sharply accented by the black painted structural steel and vivid red doors.

## H. J. HEINZ VINEGAR PLANT

Pittsburgh, Pennsylvania 1953

Skidmore, Owings & Merrill

Gordon Bunshaft, *Partner in Charge*

*Aluminum mullions, sash and door frame form a brilliant pattern on the blue background of hammered, heat-and-glare reducing glass. Even the open vents contribute note of informality to the pattern. It has been called handsomest industrial wall in Pittsburgh.*


PRUDENTIAL

# PRUDENTIAL BUILDING

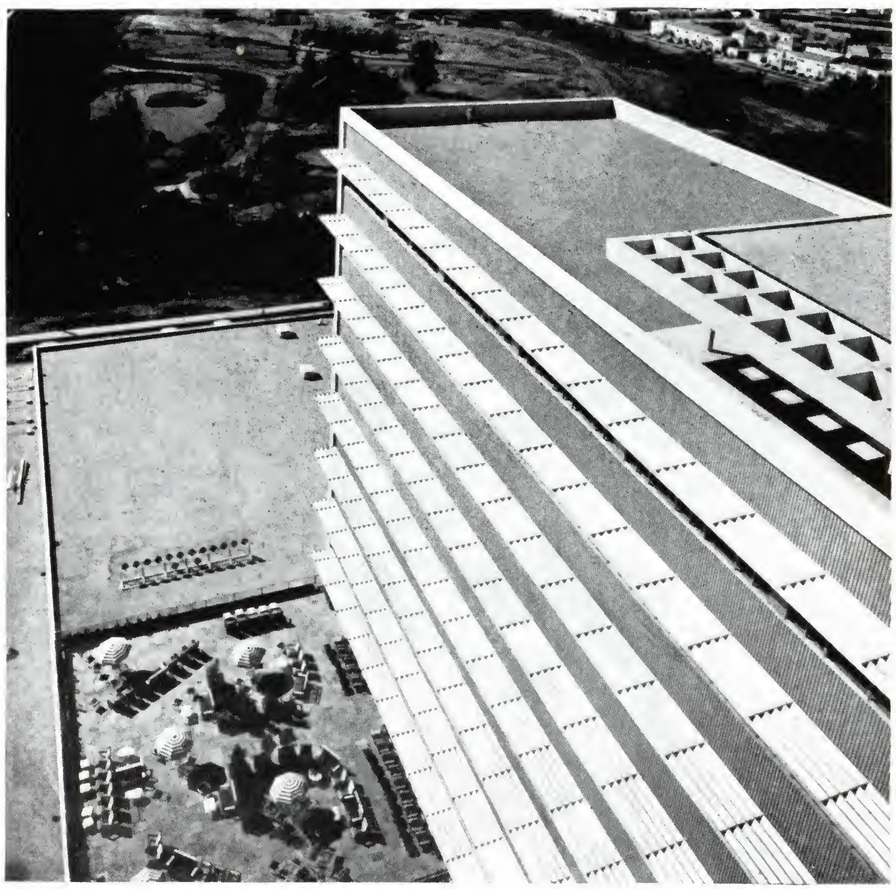
Los Angeles, California 1949

Welton Becket & Associates

Southern California's architects were early to recognize the effectiveness of aluminum as protection against solar heat. This trim, new office building, one of the largest on the Los Angeles skyline, uses aluminum louvered sunshades pleasingly contrasted against vertically fluted terra cotta tile which was applied over poured concrete spandrels. Light weight aggregate, such as pumice and vermiculate combined with aluminum to reduce deadweight to a minimum; as a result, about 1000 tons of structural steel were saved. Such deadweight saving is especially important in Los Angeles where deadweight is a major factor in seismic stresses. Located so near the famous La Brea tar pits (where prehistoric animals were trapped and preserved), test borings indicated only 17′ of firm soil. Therefore, the building was erected without a basement on spread footings instead of piles.

All the sash, storefronts and most of the trim are of aluminum. The sign at the top of the service tower was cast of special aluminum alloy. Thoughtfully planned and dramatically designed to suit the client's needs, the building is spread over the ample eleven-acre site with a parking area for 1000 cars.

*The 325′ sweep of aluminum sash and sunshades is played off against stone texture of service tower. Department store occupies three lower floors, top right.*

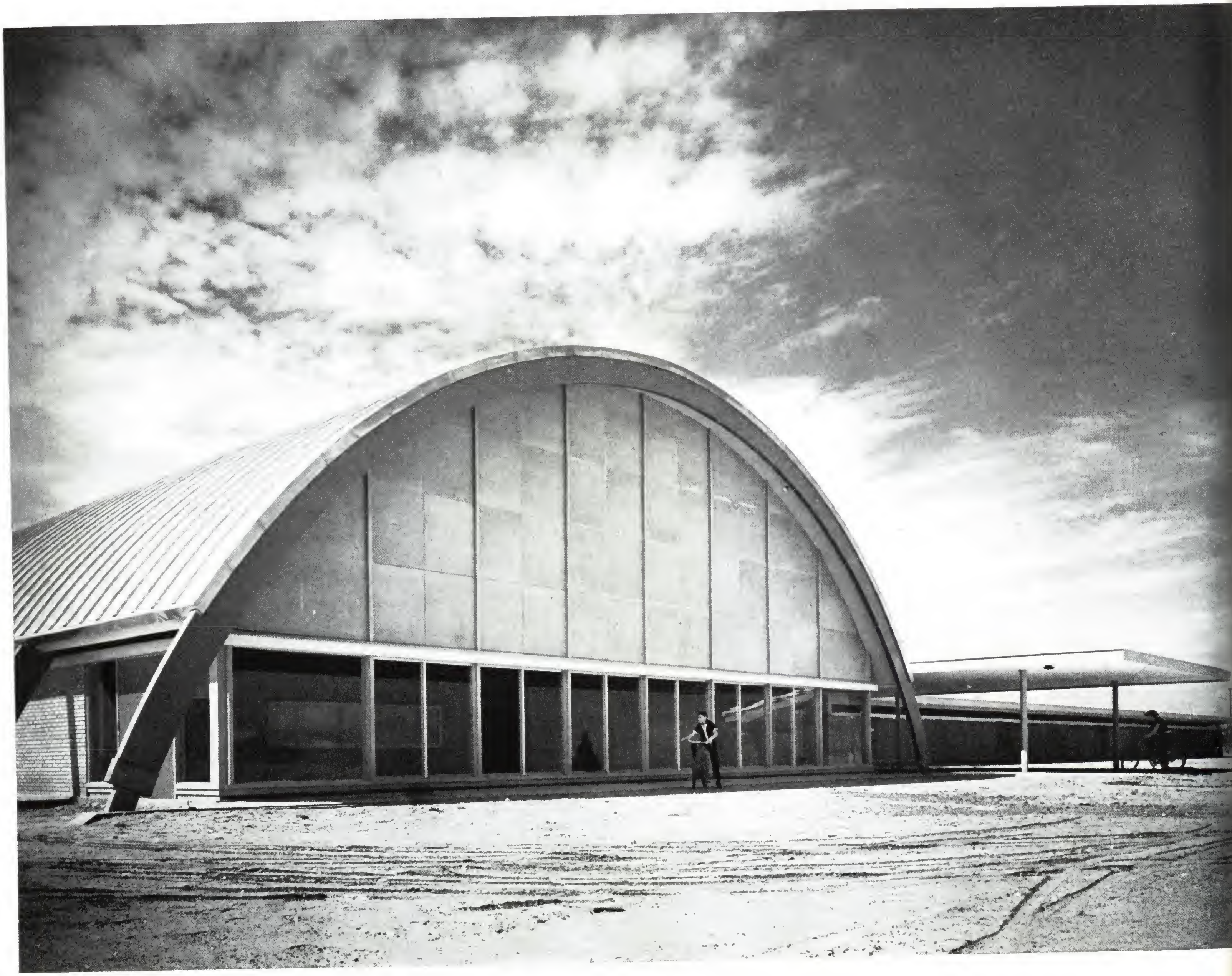


*Sun load on building is controlled on all sides by combination of sunshades and windowless walls. Dining terrace, at the right, makes use of roof area over stores.*

# MIRABEAU B. LAMAR JUNIOR HIGH SCHOOL

Laredo, Texas 1953

Caudill, Rowlett, Scott & Associates

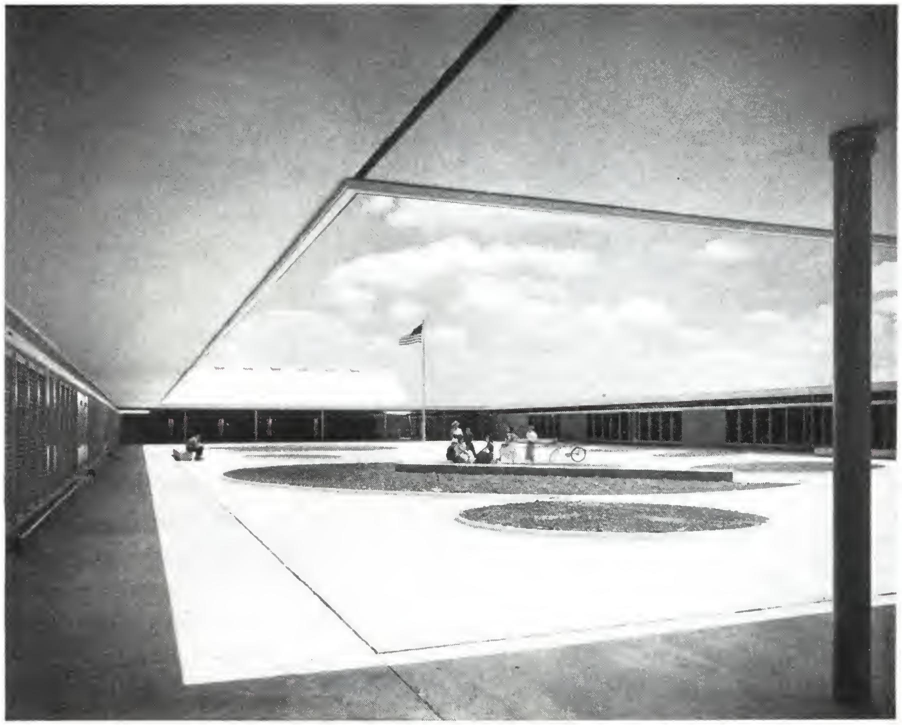


This well-known Texas school has been widely studied for a number of planning innovations such as deep back-to-back classrooms and ventilation through a central service core. The mild Texas climate permits access to all classrooms from outdoor corridors, and the buildings are swung around all four sides of a broad central plaza.

The half-auditorium, half-gymnasium section, shown at left, is roofed in aluminum and supported by laminated timber arches. The dramatic arch of this building element contrasts with the low classroom buildings, roofed by a concrete lift slab. The concrete slab projects to shade classroom window walls and provides covered walkways all around the plaza side of the buildings.

The two structural systems are skillfully expressed in the wall treatment of each building type. Underneath the arched roof of the gymnasium section there is a luxurious folding wall that opens gymnasium interior to the out-of-doors. The walls of the classroom buildings, under the lifted concrete slab, are virtually made up of glass jalousie windows set in aluminum frames.

Another innovation in this pace-setting school plan was to place all cupboards and sinks on the back wall adjoining the central service core and so free all room-dividing walls for use as teaching surfaces. These partitions were installed as corkboard, chalkboard or pegboard—not mounted over a wall, but nailed directly to studs. The service core separating back-to-back classrooms is wide enough to give access to plumbing pipes, but otherwise is not entered. Ventilation is handled by means of grilles located in the back of each classroom. The ventilators are so placed and the core is wide enough so that classroom sounds are completely baffled.



*Classrooms surround broad plaza on three sides with the large gymnasium-auditorium under an arched aluminum roof along the fourth side, at rear above. Note how rhythmically classroom wall is opened below the solid slab roof by window sections. On opposite page is shown close-up, end view of gymnasium-auditorium.*

# SOAREZ HOUSE

Petropolis, Brazil 1952

Sergio Bernardes

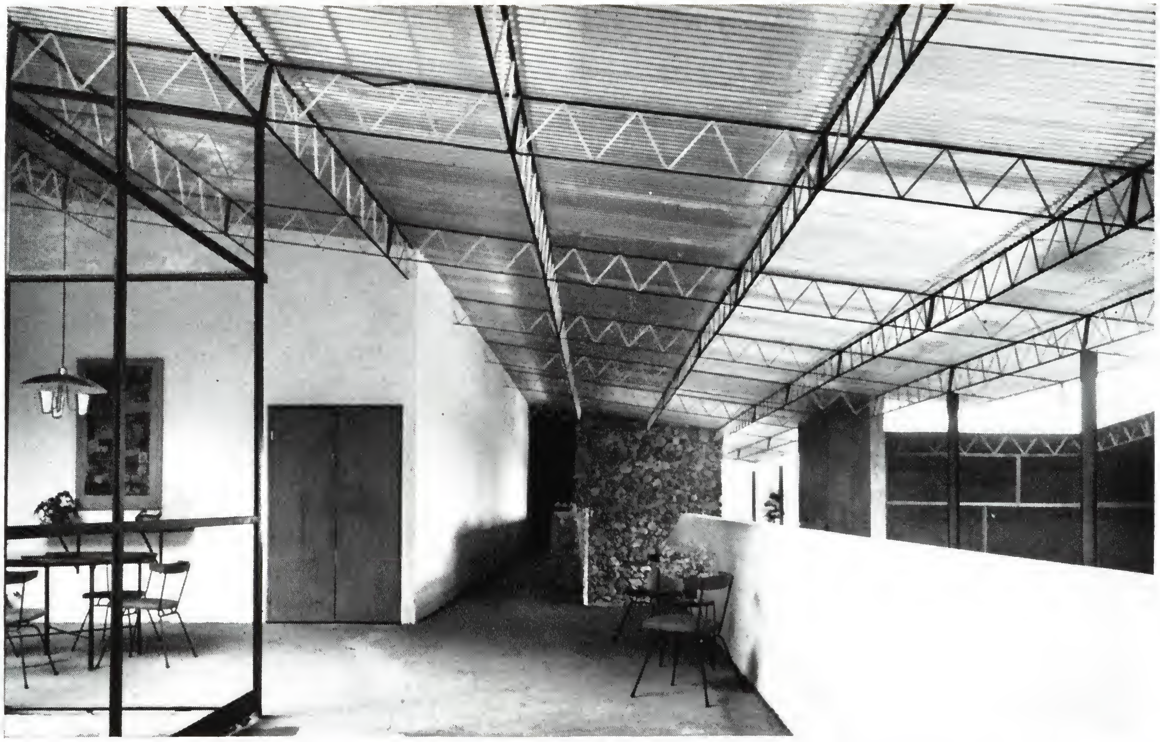
Set high in the spectacular and inaccessible mountains of Brazil, it was virtually impossible to transport large or heavy building materials to such a site. But using what was available locally, and bringing in lightweight prefabricated aluminum roof trusses and aluminum corrugated sheeting, the architect created a stunning mansion in the wilds.

It is a house of big airy spaces and long light spans, contrasted with walls of massive stone and rough, unglazed brick—a striking example of the remarkable esthetic effects that can be achieved when primitive and technological materials are combined with imaginative artistry.

Because the architect wanted to make the most, in the interiors, of his drama of materials, he preferred not to conceal his corrugated aluminum roof skin with acoustic insulation. The aluminum itself provides sufficient thermal insulation. So to deaden the sound of rain drumming, he covered the outside of the roof with grass mats—a curious sort of latter-day thatch that effectively accomplishes its purpose.

This house design won for Architect Bernardes the prize awarded by the Second Biennial at São Paulo for recent work by young Brazilian architects.

*Flow of open and closed spaces of the house is both dramatized and unified by the lacework of aluminum trusses. Block at left contains bedrooms. The roof in the foreground covers living room, office, and veranda. Steamy, mountain forest site shows at rear.*



*Upper gallery from the bedroom block flows into dining space, next to closed kitchen. Beyond are guest rooms and servants' wing. Sweep and delicacy of trusses emphasizes lightness of the aluminum roof. Below left, the roof pitches upward toward the south (this is below the equator). Right, view of galleries toward bedroom block.*

# CARACAS UNIVERSITY CITY

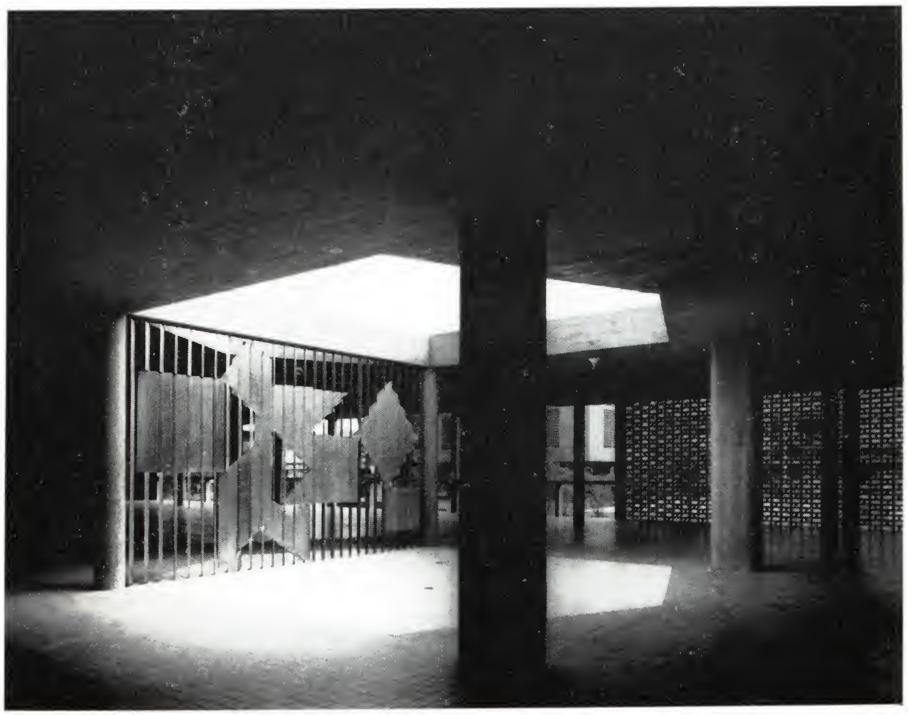
Caracas, Venezuela 1953

Carlos Raul Villanneva

Mateo Manaure, *Sculptor*

While opinions are sharply divided concerning the architectural quality of modern Caracas University City, everyone agrees that its integrated art is something to marvel at. Throughout the campus, murals are widely used as whole walls and space dividers; sculpture was introduced as important focal points and even as huge light deflectors in the main auditorium. It was no accident that the murals and sculpture became truly integral parts of the buildings. From the very beginning the architect worked in close collaboration with a host of talented artists and sculptors, both Venezuelan and foreign.

Outstanding because of its architecturally planned use of daylight is the aluminum bas-relief wall shown on these pages. Its designer uses the plastic qualities of heavy sheet aluminum to achieve a striking play of light, subtle reflection and shadow. The triangular roof opening, seen in photo at left, casting a triangular pool of light on the floor, is a satisfying extension of the wall design composition.



*Triangular roof opening, left, adds to the play of light and shadow. Murals and sculpture are largely of abstract school, do not reflect folk art or politics.*

*Cultural center of University City is library and auditorium buildings at middle of photo, above right. Bas-relief aluminum wall is located in covered court.*

*Main light source for sculptural wall is an opening in slab roof shown in the view at right. Architect planned sculpture to be more than merely decorative.*

## STATE GAME DEPARTMENT BUILDING

Seattle, Washington 1949

James C. Gardiner & Associates

*Stock aluminum sash, handled simply, provides a building-height glass front. Windows, in horizontal bands, dramatize entrance lobby height.*

*Light aluminum framing and generous use of glass give a look of luxury to this low-cost building. Openness of entry is typical of today's public architecture.*

The light, open construction of this combination office and warehouse building designed for the State of Washington is a good example of the changing character of public building in the United States. The monumental forms that were considered essential for government buildings only a decade or so ago have virtually disappeared. The new, open buildings are the product not only of a new philosophy of architectural design, but also of unrelenting economic necessity. Skyrocketing building costs have encouraged many a conservative public body to turn to the modern architect's skill in making the most out of a close budget.

Set on a sloping city lot, this good-looking building provides two floors above ground level in front and three floors at the back of the site. A two-story wing at right angles provides a convenient roof parking space for employees.

Reinforced concrete construction and stock aluminum sash help keep costs within a low (1949) budget of 76 cents per cu. ft. Aluminum spandrels also add a discreet horizontal pattern between the long window sections at the side of the building.

*Title and seal of State Game Department in cast aluminum are set on brick panel.*

## CONSOLIDATED VULTEE HOUSE

U.S.A. 1947

Henry Dreyfuss and Edward L. Barnes

This appealing all aluminum prefab would seem a logical design for mass production assembly line technique—stamping out large sections of metal with the speed and precision of an automobile body—and it is. Such innovation would also be expected to confront opposition—and it did. Local codes and marketing difficulties made production impractical and the project was postponed until the designers and their collaborators, the Consolidated Vultee Aircraft Corp., might find a more favorable climate.

*Besides its trim, contemporary appearance, this U.S. prefabricated aluminum house had many other outstanding features, including: prefabricated plumbing grid with kitchen and bath back-to-back, flexibility in placement of fenestration, and a patio wall included in the package.*

Between this European aluminum prefab and the American design on the opposite page there is considerable difference both in design and construction. But, perhaps the largest difference is that the Prouvé design is a thriving reality. The vertical aluminum struts, showing on the exterior, are the main structure on which the roof and aluminum panel system are joined. Easily transported and erected because of its light weight, the exterior is obviously simple to maintain, either left natural or painted.

# PROUVÉ PREFABRICATED ALUMINUM HOUSE

France 1953

Jean Prouvé

*This practical prefabricated home of lightweight metal is being erected throughout France. Living room, cantilevered from stone foundation, has large window, right. Building's size is practical for summer home or cottage; another larger house by same designer can be seen on page 144.*

One of the identifying features of this towering 20-story bank and office building is its superstructure. A continuous bank of horizontal aluminum louvers, two stories high, encloses mechanical equipment and finishes off the top of the building with admirable finesse. But, this superstructure is most remarkable because it contains the boiler room with only a small natural gas fuel line running up through the building rather than the usual smokestack. The heat is fed down through the building instead of up.

## FIRST NATIONAL BUILDING

Tulsa, Oklahoma 1950

Carson & Lundin


*With the columns of this southwestern bank building set behind windows, the wall was provided with an unusually strong horizontal treatment. Light gray brick spandrels alternate with bands of glass set in the criss-crosses of gleaming aluminum sash. Executive offices enjoy an attractive garden terrace on the setback. First floor contains the lobby, shown above, and stores.*

## UNIVERSITY OF MIAMI THEATER

Coral Gables, Florida 1953

Robert M. Little and Marion I. Manley

*Theater auditorium is a concrete dome, its "wall" completely formed of movable aluminum jalousies. Peripheral building elements are offices, dressing rooms and workshops. Jalousies, left, set from slab to underside of dome, are screened for insect protection; upper and lower portions of each jalousy strip can be moved independently.*

The most obviously striking feature of this university experimental theater is its domed auditorium, designed to accommodate nearly every sort of seating arrangement from the theater-in-the-round performances to the rectangular Elizabethan stage of William Shakespeare's time.

Less obvious is a more common problem: how to get rock-bottom economy both in first cost and maintenance without shoddiness or dreariness.

For in spite of its attractive form and ingenious flexibility of seating, this could easily have been a grim, repelling building. Its construction—walls, piers, slabs and dome—is unfinished concrete. At a budget of less than $10 per sq. ft. the architects were allowed virtually no money for the usual play of materials, textures or colors.

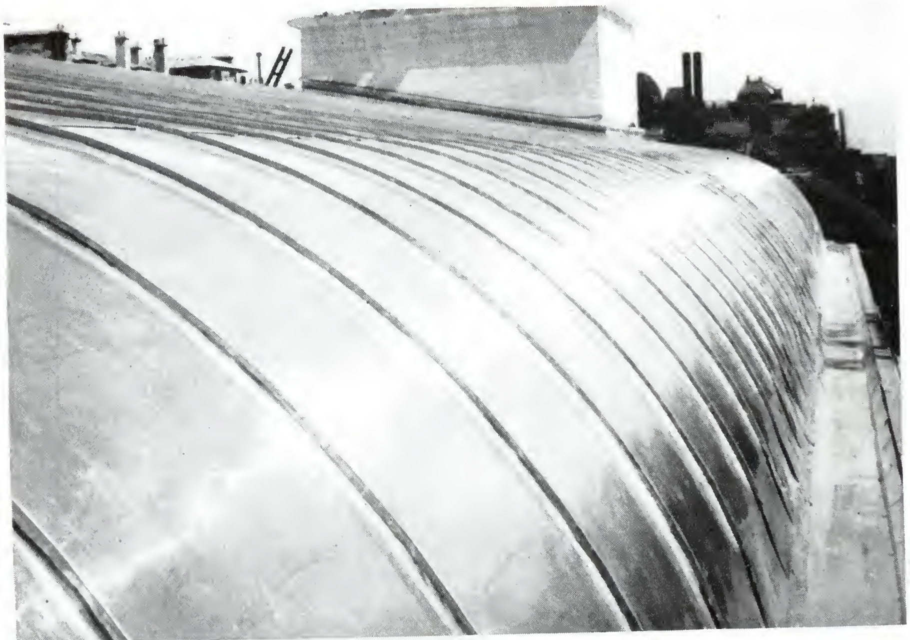
To save the building from grimness, they cleverly made the most of the theater's perimeter wall. The top-to-bottom screened aluminum jalousies they selected give relief and contrast to the concrete and provide infinitely varying textures of light and shade, in addition to fulfilling their primary purpose of providing maximum ventilation in the subtropical Florida climate.

With maintenance money almost non-existent, the aluminum curtain does the double job of keeping the building comfortable while providing in good measure a precise, friendly, and clean appearance.

# FRENCH MASTER BUILDERS' FEDERATION OFFICES

Paris, France 1951

Raymond Gravereaux and Raymond Lopez



*The light weight of this sheet aluminum roof as well as other aluminum members helped to reduce the cost of the structural system which consists of eight reinforced concrete columns. Rounded shape of roof is not visible from ground, photo at right.*

Set in a garden court, this aluminum and glass sheathed office building looks composed and at home beside the masonry pilasters of the elegant nineteenth century house at the other end of the garden. The Builders' Federation remodeled the house to provide rooms for conferences, receptions, and other functions and added a 5-story building with offices for administrative and technical personnel. The new building has walls of quarried stone, requested by the planning commission, which help the two units grade easily from one century to another.

Prefabricated aluminum wall panels, designed to a 4′-8″ module, are used for the main walls of the office building. They arrived at the site already glazed and painted and were placed in a frame for mechanical hoisting and setting. They were bolted to metal clip angles, which in turn were attached to the top and bottom of the projecting concrete floor slab by a long anchor inserted through a vertical sleeve in the slab.

Projecting floor slabs meet the projecting vertical stabilizing members at either end of the building façade to provide a nicely finished frame for the prefabricated wall. For ventilation, one glass section in each window is set in a movable aluminum sash.

*Garden court façade of this French office building shows an assured handling of aluminum and glass wall panels. Prefabricated in one piece already glazed, the panels were hoisted into place rapidly with a jib.*

*Entrance, right, is through an aluminum-framed door beneath the carport eaves, into a hall with window-pierced masonry on one side, bedrooms on the other.*

*Living room opens out into dramatic space beyond the small, secure passage. The walls dissolve into aluminum-framed glass with garden terrace just beyond.*

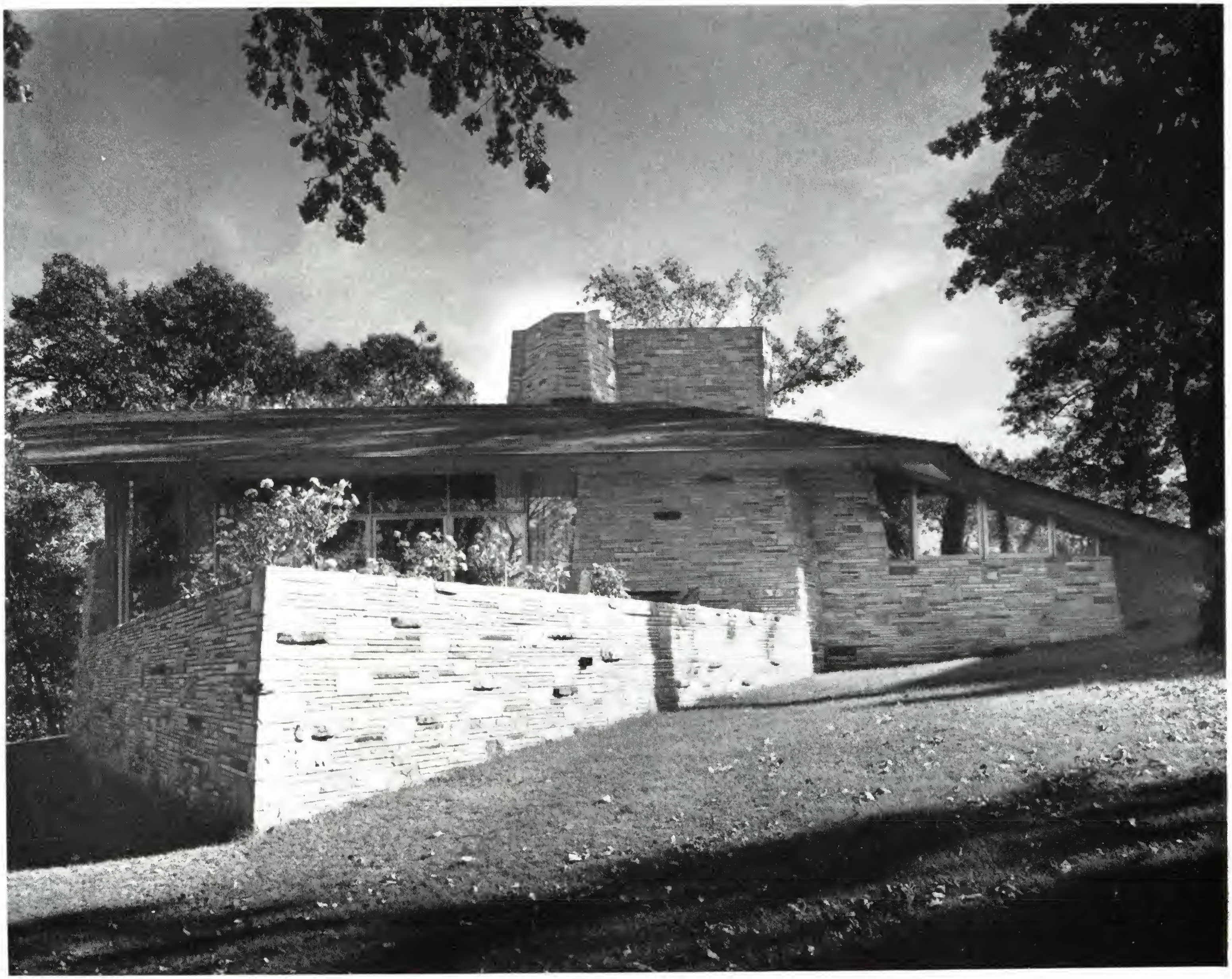
The essence of shelter itself is expressed in the sweep and dip of gables, the wide protective eaves and the reassuring solidity of masonry. The site is intrinsically romantic, woodland and lawn sloped to a tranquil lake. It too is dramatized, first by the very lines of the house, and then by the great triangular glass wall and the prow of the terrace pointing outward to the water, seen here at the right.

One of Wright's great gifts is his extraordinary feeling for the nature of materials. Here, with a master's touch, he has personified the weight and ruggedness of stone, the magic transparency of glass, the precision and cool grace of aluminum—used not only in the conventional rectangular door and window shapes but often with sweeping angles combined in unusual mass and surface relationships.

## NEILS RESIDENCE

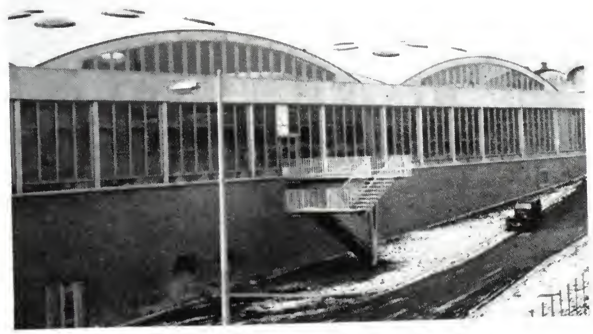
Minneapolis, Minnesota 1952

Frank Lloyd Wright



Buildings such as this factory—roofed over with huge, paper-thin concrete shells—were born out of the necessities of the postwar years, necessities that have proved to be a tremendous boon to architecture and engineering progress.

For this 146,000 sq. ft. factory is sheltered largely by nine reinforced concrete domes, each spanning 85′ in one direction, 62′ in the other. And yet the domes are only 3½″ thick! Moreover, each of these thin concrete shells is perforated by clusters of



circular skylights that created a host of additional engineering problems for the architect.

The walls of the rubber factory are framed in reinforced concrete used more traditionally, with bays between structural columns largely filled by fixed glass set in aluminum extrusions, or aluminum sash. The airy glass and aluminum provides a striking contrast with the thin but solid concrete structure of the factory.

Called "Britain's best postwar building," the illustrations on these pages help to explain why.

*Box-like employees' locker rooms at the left are cantilevered out from main structure and faced with precast concrete panels. Below are workshops with glass walls divided by aluminum mullions and muntin bars. Top: one of nine thin shell concrete domes, showing skylight perforations, clerestory windows around edge.*

# BRYNMAWR RUBBER LTD. FACTORY

Brynmawr, South Wales 1950/51

Architects' Co-operative Partnership

*South facade of rubber factory expresses different elements of building-complex: series of small concrete vaults, at far left, shelters printing and spreading shops; main production area with nine large, thin shell domes, is in the center; and the monumental entrance hall with its single vault roof is at far right. All fenestration, movable and fixed, is of extruded aluminum. Body of water in foreground of illustration is a reservoir.*

# DECIDUOUS FRUIT BOARD BUILDING

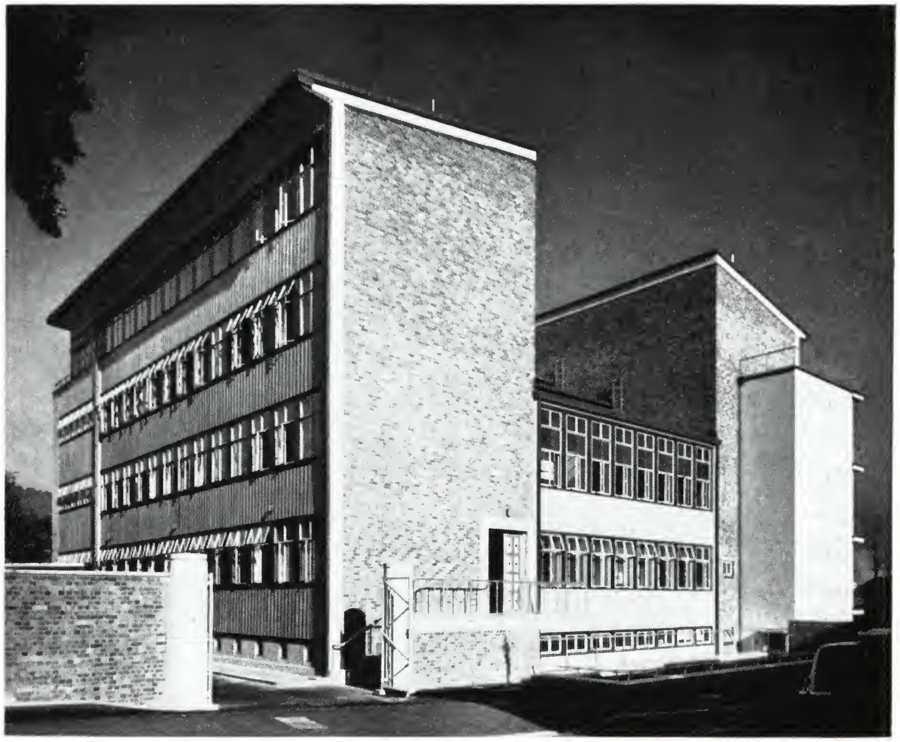
Capetown, South Africa 1952

Thornton White, Pryce Lewis & Sturrock

The unique shape of this headquarters office building, whose center section seems to have slipped down two stories between its gable ends, neatly solves a tight space problem on a city lot. Setbacks from two streets and a residential zoning restriction at the back, left the architects a square buildable area only 90′ x 95′. The fourth side, adjoining another lot, had to be a windowless party wall. The solution: a square building with a "bite" taken out of the top for light and air. Storerooms and air conditioning equipment are partially buried on a lower ground floor; general offices are arranged around an interior board room on the upper ground floor. Above the next office floor the center section is stepped back toward the party wall to gain a series of clerestory windows that light the deep interior.

On the three major facades long ribbon spandrels of anodized aluminum emphasize the lightweight "curtain" character of the building's skin. In sharp contrast, windowless sections are separated and treated as massive brick panels; these are edged in concrete bands that suggest the building's reinforced cast stone skeleton. The aluminum facing, ribbed on 9″ centers for added strength, lends both brightness and shadow pattern to the exterior. Aluminum was decoratively used for the exterior railings and doors.

*Elegant aluminum railing at the rear entrance of building is set off by pair of ornamental aluminum doors.*

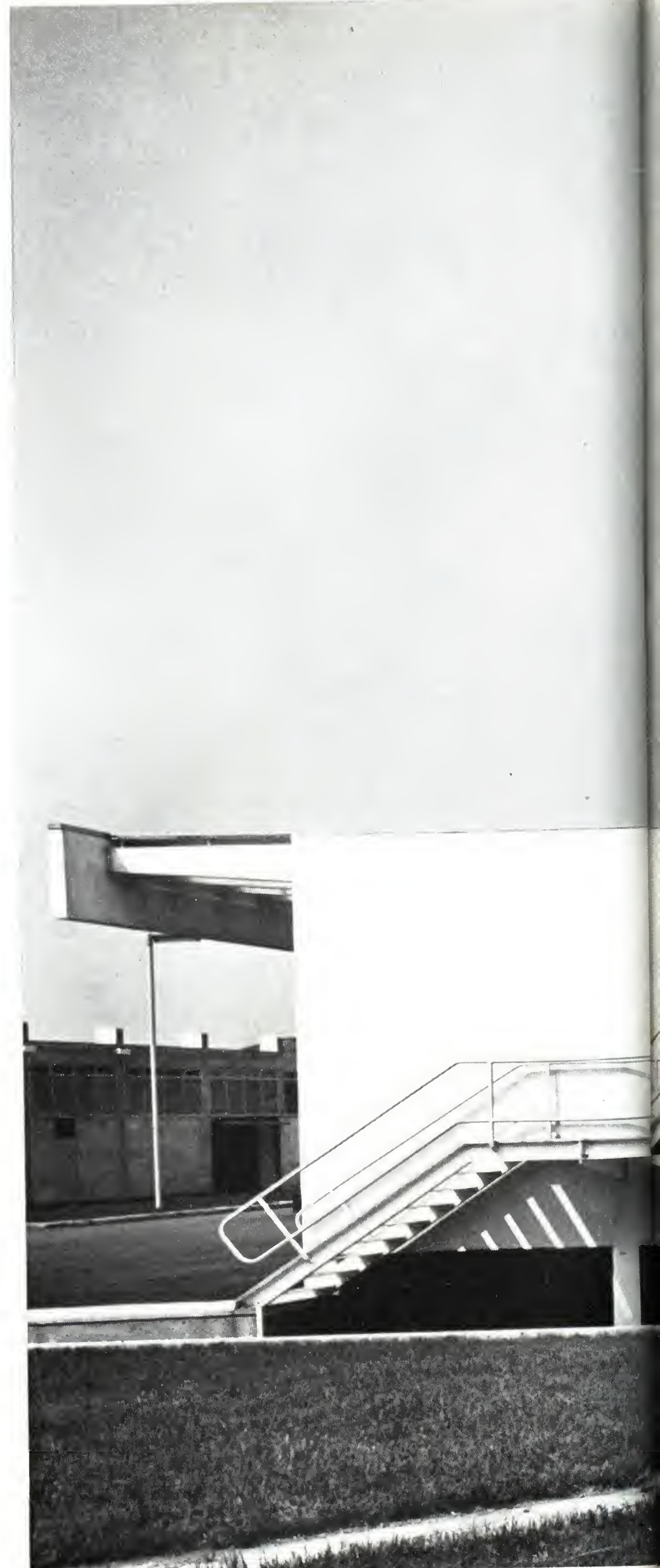


*Center section of office building steps back to form a lightwell for deep interior rooms. Ribbon spandrels are anodized aluminum. Brick veneer walls have cast stone trim.*

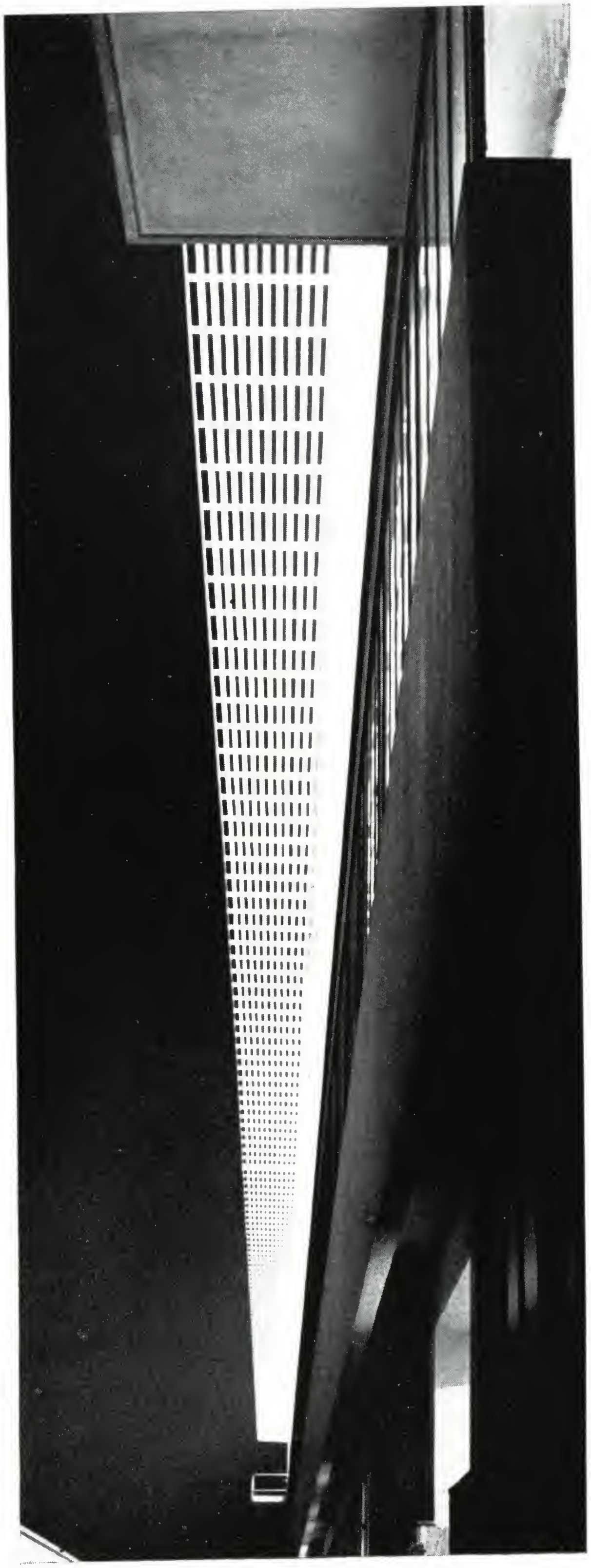
# FARMITALIA PHARMACEUTICAL FACTORY

Milan, Italy 1953

Gian Luigi Giordani



*Southeast corner of pharmaceutical plant shows some of the elegant detailing that distinguishes this building as one of Europe's best industrial structures: a gracefully cantilevered stair, a repetitive pattern of slim, aluminum window mullions and the contrast of plain, flat surfaces with small-scale grids. The large hall behind the glass facade is a two-level department dealing with the measuring, sorting, labeling and shipping of the factory's products. Factory areas are well lighted by large glass areas protected from direct sun by venetian blinds or solar shades.*



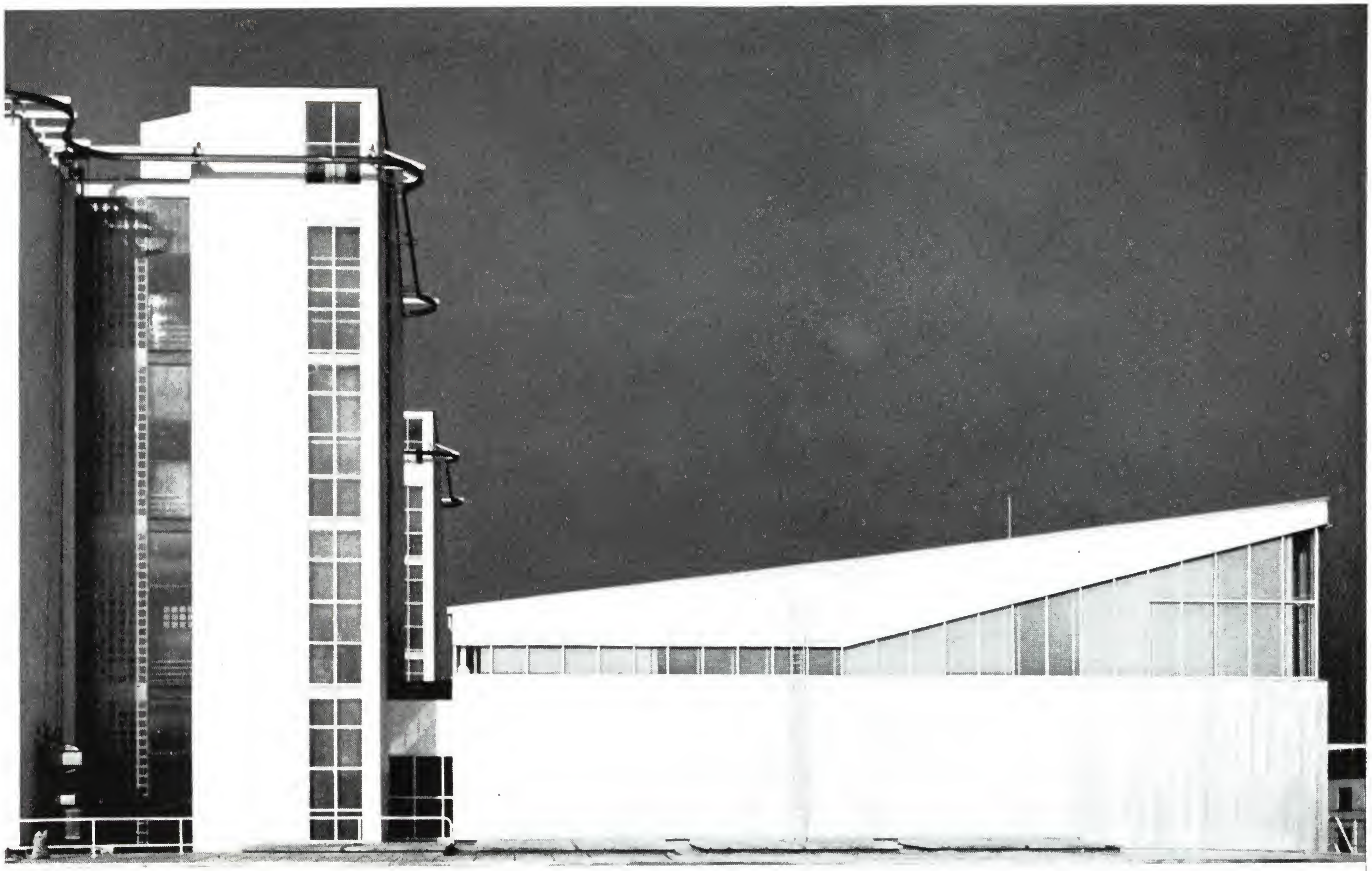
This handsome factory is a first class European example of how meticulous design can give style to economical standardized building materials. At the same time the planning is so straightforward that it gives an almost diagrammatic picture of the way in which pharmaceuticals are produced.

The process starts with the raw materials, and these are first dispatched to the top floors of the two tower buildings that dominate the factory. As the raw materials are processed in shops and laboratories, they travel downward until they reach the upper level of the long, two-story hall-structure that runs the length of the plant. Here the products are measured, sorted, labeled and, finally, sent to the lower level where they are shipped.

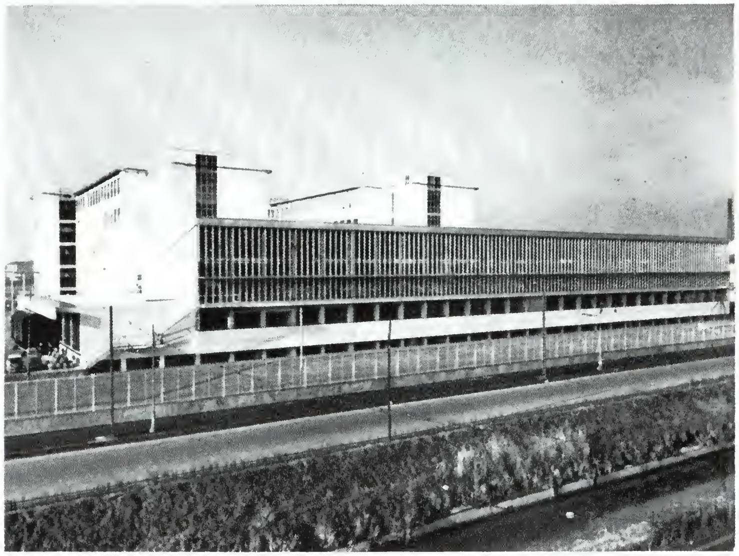
Details of this factory show imaginative design: all interior partitions are demountable; the aluminum windows in the two 5-story slab buildings can be washed from the outside, from a suspended "cable-car" that travels on an overhead rail all around the periphery of the building; and the heating system is a grid of hot water pipes, hung from the ceilings and faced with aluminum panels that distribute the heat throughout the spaces below.

Other noteworthy details, the fluorescent lamp standards, the simple stairs, the clean finishes, including aluminum sheet for roof, all demonstrate industrial architecture of efficiency and elegance.

*Thoughtful, meticulous detailing shows up handsomely from any angle. This horizontal grid, view at left, stretches along the full length of the west façade. It reduces sky glare and breaks up direct sunlight as well as providing a convenient catwalk access to windows.*



*Design of plant is given particular identity by treatment of the long, low 2-story building, above. Fenestration pattern, with slim aluminum mullions enhances otherwise commonplace shape of shed-roofed end wall.*



*Only two 5-story towers are visible in view at right. Towers contain shops and laboratories; the low building contains distribution facilities. Neatness of plant helps emphasize purity of pharmaceutical products.*

# NIEMAN-MARCUS STORE

Preston Center, Dallas, Texas 1951

Dewitt & Swank

This suburban branch of Dallas' most famous store has a subtle combination of suburban informality and urban luxury. This blend is intended to put the shopper in the most relaxed but expansive mood for buying. These requirements made mandatory very close attention to the all-important design of the interior—in fact, the interior designer was called in early in the planning stage and the building's plan evolved out of close cooperation between the architects and the interior specialist. Particular emphasis was given to the selection of modern materials and agreeably related colors, both inside and out. Aluminum is one of the key metals in the plan, used widely on the broad window walls and on much of the trim and hardware.

Because of site limitations, the store was forced into the ungainly shape of 90′ x 320′. To relieve this extreme proportion, a patio was created toward the middle of one side, producing a shallow U-shaped plan. The store's four entrances on three sides each command a wide 90% view of the total sales area.

*In addition to a selection of smart furnishings, lavishness of interior, opposite page, was achieved through the use of open space, often with ceilings two floors high.*

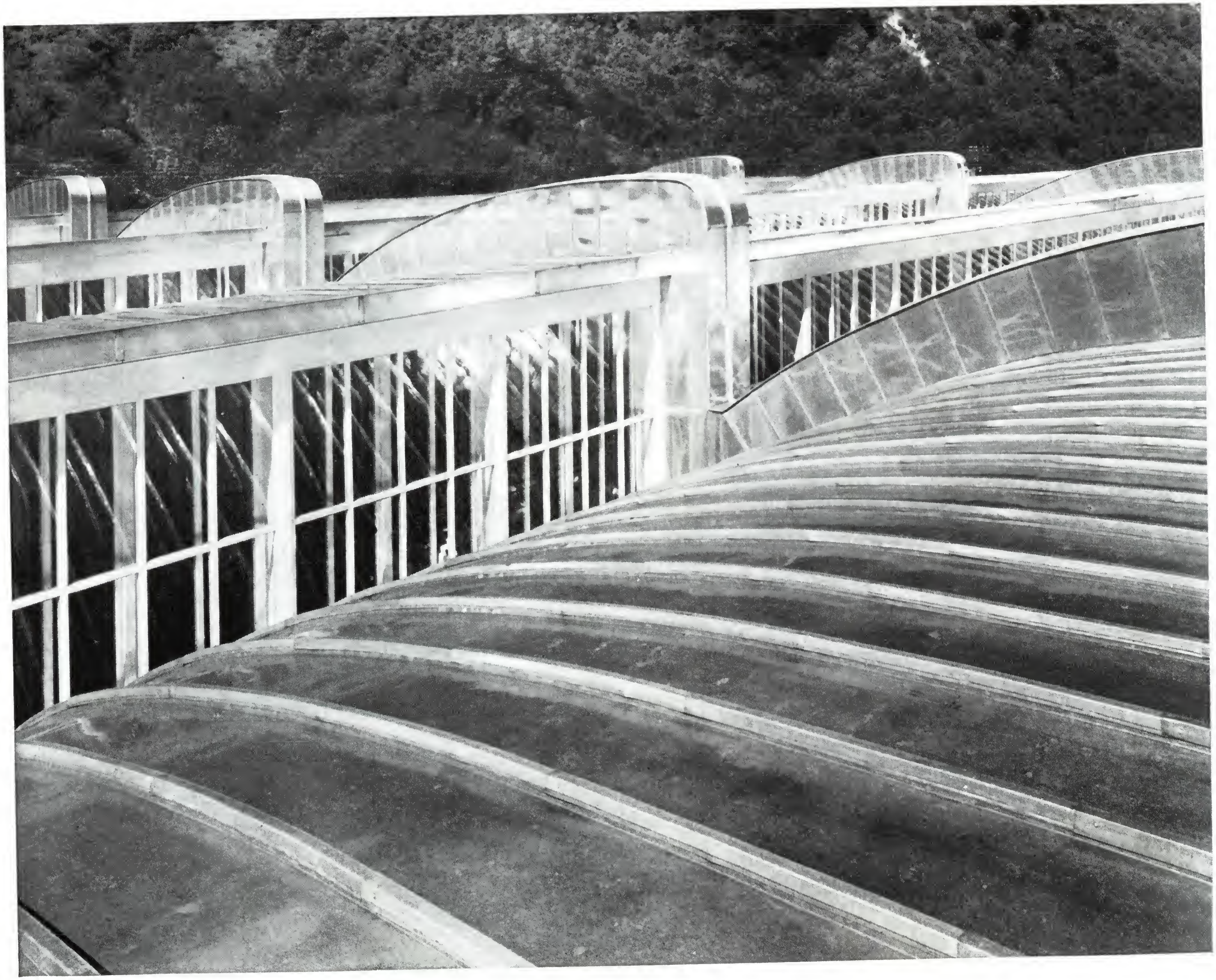
*Wall on patio side of store, above right, has ample, 2-story window areas that flood the sales floor with daylight and intensify tasteful selection of interior colors.*

*Aluminum and glass wall at center entrance of the store, lower right, faces the shallow, landscaped patio. The store has 63,000 sq. ft. of luxury shopping area.*

## TENAY SPINNING MILL

Tenay, near Lyon, France 1946/47

Suter & Suter



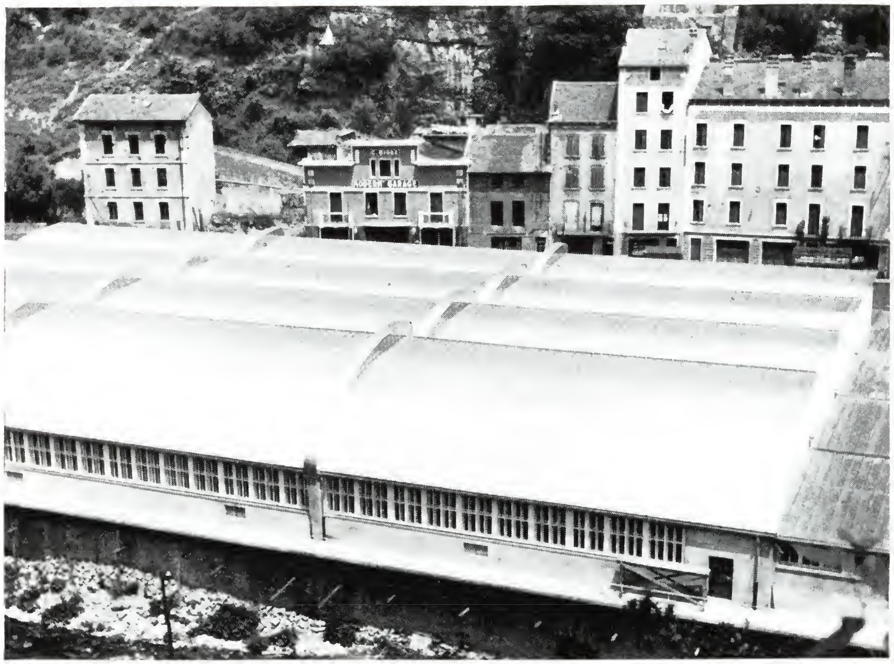
Much building in France immediately after the war was severely handicapped by material shortages. When this bombed-out spinning mill was rebuilt, however, such handicaps seem to have encouraged its architects and engineers to try for greater-than-average ingenuity in the planning.

The problem was to enclose some 23,000 sq. ft. of manufacturing space, to avoid the usual forest of interior columns, and to admit an abundance of natural light—evenly distributed from above.

The solution was to erect a shell-concrete structure supported on only six interior columns spaced far apart. The columns are part of a system of rigid frames designed to support the thin-shell roof. The profile of the structure is a modified sawtooth pattern which produces 200′-long skylights above the entire manufacturing area.

To permit such great spans and so few column supports, the weight of the roof shells had to be pared down to a minimum. Precision engineering helped to cut down the thickness of the concrete to a mere 3″. Furthermore, the aluminum sheets used to surface the roof help greatly to reduce the dead loads that had to be supported.

One unusual aspect of this structure is visible only in those pictures taken from above: the heavy frames that support the shells project above the roof surface, like some unusual system of buttresses. This was done to leave the ceiling below unobstructed by beams. The result is an excellent distribution of natural light inside the building, with the smooth ceiling shells acting like huge light-reflectors. The frames that project above roof are aluminum-sheathed also, thus giving the complete structure a continuous skin of heat-reflecting metal.



*Modern, clerestoried factory building stands out strongly amidst traditional French buildings. Continuous structural frames project up through the waves of the roof and carry the shell concrete vaults below. The entire roof is sheathed with aluminum.*

*Close-up, left, shows sawtooth skylights, projecting structural frames. Interlocking sheets of aluminum make a tight skin, are permanent and relatively maintenance-free. Expansion and contraction of the metal is taken care of in the rib-joints that divide the vaults.*

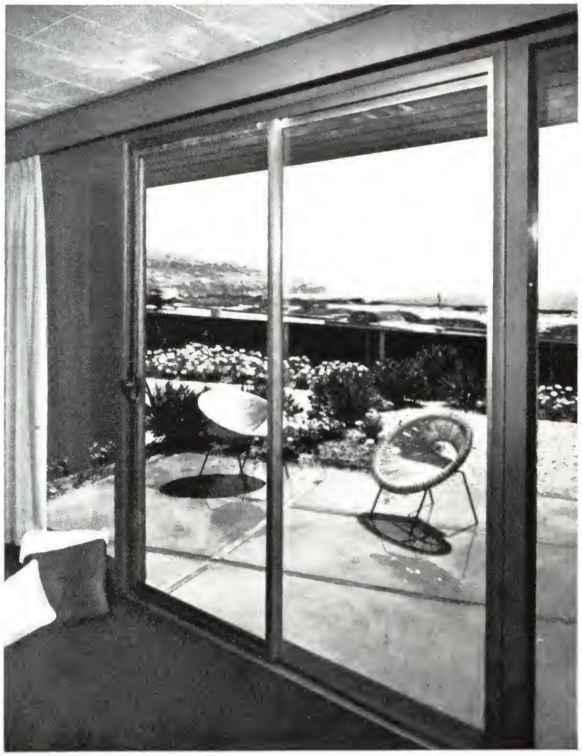
## EDGEWATER APARTMENTS

Hollywood Riviera, California 1954

J. Merrill Gray

This compact Southern California apartment building has its six units planned horizontally. The architect's friendly, well-ordered arrangement has done much toward providing the living amenities of a private home for each tenant. The construction economies of its half dozen nearly identical units are quite obvious.

The all-glass front facing the Pacific Ocean can be opened with aluminum sliding glass doors. While the sliding glass wall has long been popular in contemporary residential architecture, it has often had the drawbacks of shrinkage, expansion when framed in wood, maintenance and sheer weight when framed in steel. These problems have been overcome with this well-designed door system. Made of strong, extruded tubular aluminum construction, the lightweight doors run smoothly and effortlessly. Aluminum parts have a clear anodized finish that resists the salt air and moisture of this coastal area.



*Lightweight sliding doors, above left, use flush to floor extruded aluminum threshold as track with head alignment achieved by specially designed, top centering roller.*

*Front of building has aluminum-framed, glass walls with view of ocean. Six pleasant, compact apartment units have either sitting, garden area on ground floor, or balconies for upper-floor tenants. Upper floor is reached by outdoor stairway.*

*Apartment building consists of six identical units with aluminum sliding glass doors that open at front.*

## FIRST METHODIST CHURCH

North Little Rock, Arkansas 1953

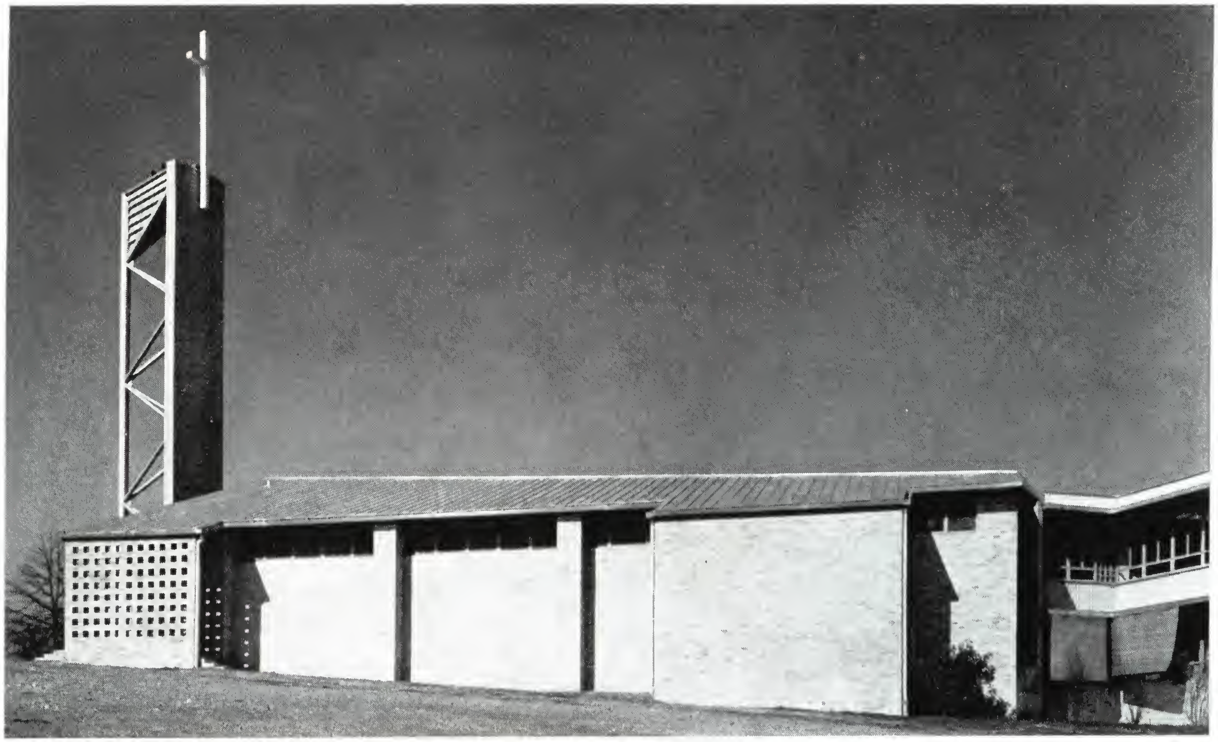
Brueggeman, Swaim & Allen

Church design is among the most sensitive and demanding challenges that confront the modern architect. Here the problem is to express certain century-old attitudes that seem to many indelibly associated with specific building forms and religious symbols. The modern architect ventures to use modern materials and new building forms to give these deep feelings an expression suited to modern living. Here the result is an extraordinarily successful one—acknowledged by a regional A.I.A. award.

This church group consists of sanctuary, chapel, educational building, community facilities, outdoor chapel, and parking space for 100 cars. Its excellence is the more remarkable for having been achieved within a low budget. Built for $10.50 per sq. ft., the building elements were sited on sloping land in such a way that practically no excavation was required.

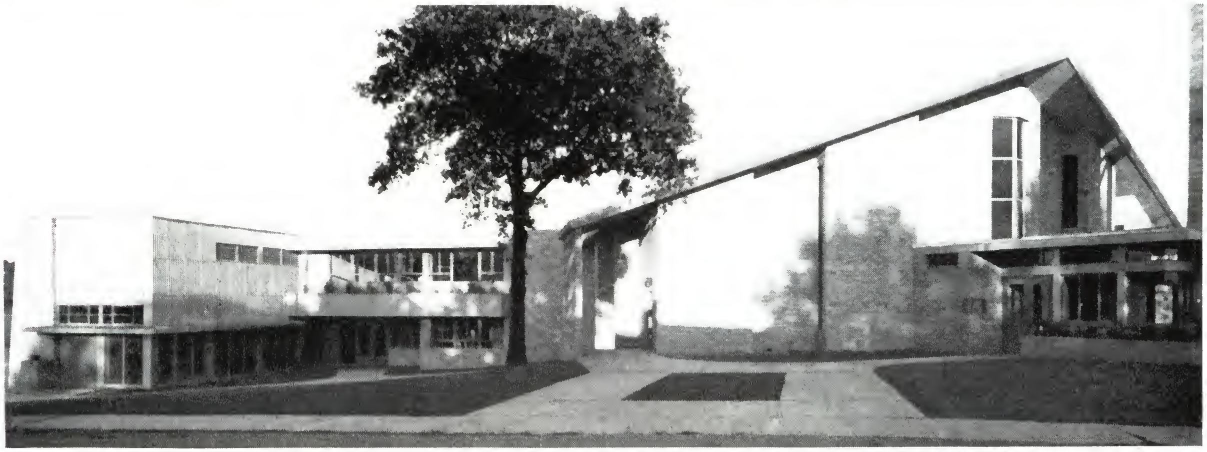
Economic materials were disposed with a general good taste which mounted to a kind of quiet drama especially in the sanctuary and other symbolic parts of the building. The happy encounter of modern materials and ancient symbols is heightened in the carillon tower of aluminum tubing that dominates the building group with its high aluminum cross.

*The carillon tower in front of this award-winning church honors an ancient tradition with one of the newest of building materials. Tower is 18" aluminum tubing, braced by 8" aluminum tubing against a vertical brick panel handled as an important part of the whole design composition. An aluminum cross surmounts the aluminum tower. Metal portion of the tower was factory built, and erected as a single piece.*



*Church sanctuary, fan-shaped because this was the most economical enclosure for the desired number and arrangement of seats, has light-weight aluminum roof. The sanctuary windows, an example of the architects' skillful use of modern techniques, are green glass with religious design symbols sandblasted in them. Wall finish is face brick.*

*Church chapel has sloped roof for added height. The structure was planned to take advantage of sloping site in a way that required only minimum excavation. Except for the top floor of the educational building, every level can be entered directly from grade. The buildings are located on a large site not far from a built-up residential area.*



# PARKING FACILITY NUMBER 8

Chicago, Illinois 1954

Friedman, Alschuler & Sincere

The city of Chicago, grappling with the critical parking problem, has sponsored a series of multi-storied parking garages which have received nation-wide acclaim. An outstanding building of the series is this aluminum and pressed-brick garage in the heart of the congested area on La Salle street.

Its eleven stories of parking area will hold approximately 525 cars. Autos can be delivered to the parking position in a matter of seconds by means of an ingenious elevator system. Four elevators in the central shaft, running from end to end in the building, move laterally as well as up and down. Consequently each elevator, carrying one car, can rapidly deliver to any floor and to almost any position on each of the floors.

Clear anodized aluminum bumper rails, showing on two sides of the building, were extruded from a die designed by the city engineers of Chicago and used for a variety of municipal projects. The rail posts of 4″ aluminum pipe are inserted into 5″ galvanized sleeves firmly anchored in concrete slab.

*Chicago's answer to the parking problem is this clean-cut maintenance-free building at right. The architectural uses of aluminum include: bumper rails, lobby doors, fixed sash, trim, gravel stops and cover plates.*

*Trim horizontal lines on open sides, left, are economically extruded aluminum bumper rails with a clear anodized finish. Rails are welded to 4″ aluminum vertical pipes and at every fifth pipe, rails are slot-bolted with a ½″ gap to take care of expansion.*

The downtown department store in many cities is the persistent reminder that business grew in fits and starts over the years. In the case of Thalhimers, Richmond's renowned century-old department store, the problem was a city block packed with buildings of assorted ages, styles and sizes.

Applying a jacket over an architectural eyesore does not represent the ideal architectural opportunity. But it is the sort of remodeling problem which frequently confronts many an architect. This grey-anodized aluminum skin was a speedy, efficient and inexpensive solution for getting the important look of a new store. The facing is made up of 3′-wide extruded, vertical, fluted aluminum panels set in a sawtooth pattern with a shallow 30° angle. They are framed in a box-top grid approximately 16′ x 24′, made of aluminum sections with a natural finish. Due to the light weight of the material, it was possible to use a girt-supporting system for the panels. Since panels were designed to interlock at the joints, panel fasteners are completely concealed from view.

*Wall detail shows box-type aluminum grid and sawtooth surface of grey-anodized, extruded panels. Horizontal mullions are extruded, vertical are formed sheet.*

*All-aluminum facade, right, applied over Thalhimers' block-long collection of retail buildings, shown at top, gives appearance of one impressive single building of uniform height. Skin forms weather-tight seal over the windows and masonry walls of the existing buildings.*

# THALHIMERS DEPARTMENT STORE

Richmond, Virginia 1955

Copeland, Novak & Associates


STANDARD FEDERAL SAVINGS AND LOAN ASSO

# STANDARD FEDERAL SAVINGS BUILDING

Los Angeles, California 1954

Welton Becket & Associates

The "slab" is one of the youngest members of the tower family and one of the most desirable because of its generous proportion of windowed space. But most slabs are a good 50 or 60′ wide. This elegant little banking and office building, in a way the last word in slabs, is only 39′-10″ wide because of its narrow, but otherwise choice, corner lot.

Clever planning within this limited dimension produced a very efficient banking layout on the first two floors. End elevators, stairs and lobby leave most of the upper floor space for two rows of private offices with a central corridor. Bank dining facilities are in the basement, a pleasant terrace on the roof.

Detailing conveys an appropriately precise, light, airy feeling, translated into an illusion of spaciousness. Mullions, window frames, sills and stools are aluminum. The spandrels are thin panels of porcelain enameled steel sheet, bonded to a honeycomb aluminum core to hold the sheets rigid. They are set into extruded aluminum frames. The principal exposure of the building is southwest, and this undesirable orientation has been satisfactorily controlled with handsome vertical aluminum jalousies.


*Wall, left, is aluminum-framed glass, porcelain enameled steel panels with honeycomb aluminum cores. Aluminum jalousies are used inside sealed windows.*

*Entrance to first-floor bank, at right, is beneath the cantilevered corner of building; entrance to office floors is at far end. Lettering is simple and well-placed.*

# CIRCULO DE LAS FUERZAS ARMADAS

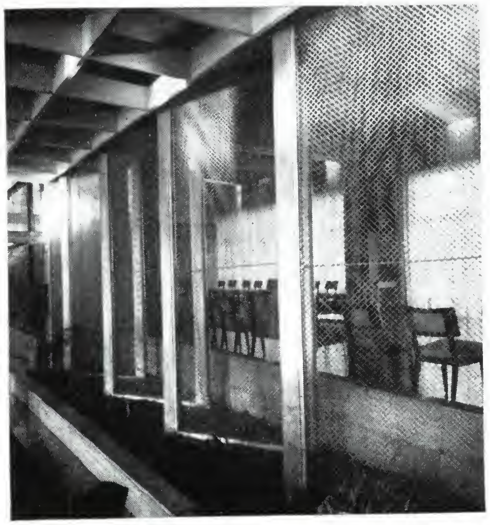
Caracas, Venezuela 1953

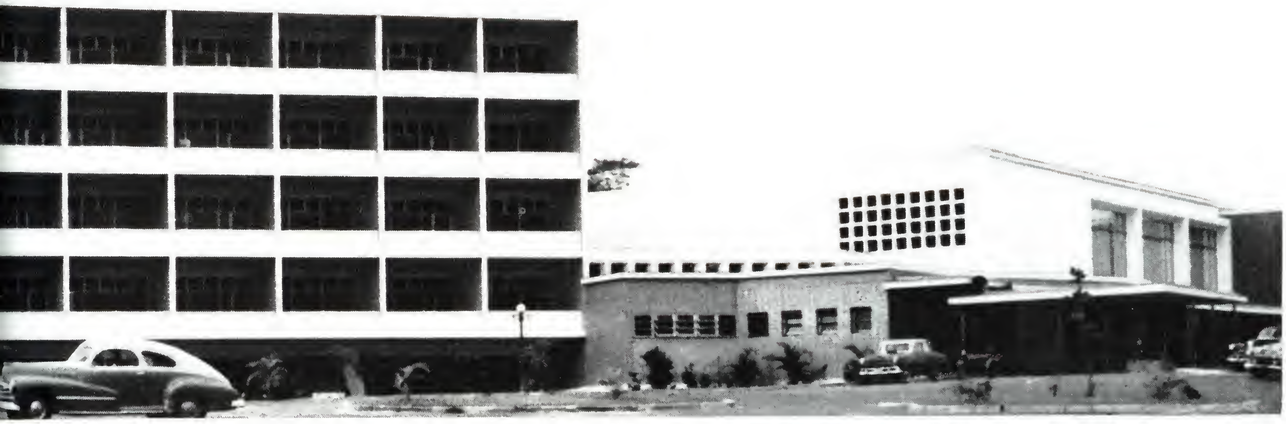
Luis Malaussena

*Aluminum mesh walls between main reception room and outer gallery will hold display of orchids, part of permanent botanical exhibit.*

*Long passageway with aluminum pipe columns at back of the Circulo leads from main reception room to a 16th century style patio.*

*Rear of the reception wing faces a broad patio used for dances. Upper floor contains picture gallery and two smaller banquet rooms.*





*Broad hotel-apartment for visiting officers and government guests, above left, combines modern and traditional finishes: aluminum for windows, terra cotta clay tile mullion and spandrel covering. Buildings to the right are, the main reception hall where large celebrations are held, and recreation building with well-equipped game rooms.*

So that the military men can enjoy social activities on a level with upper-bracket civilians, the Venezuelan Government has constructed this "Country Club" near Caracas for the use of armed forces' officers. It is a huge complex, dominated by a broad, horizontal hotel-apartment wing, seen above. This is used by officers on leave from their posts in the interior and occasionally for accommodating distinguished foreign guests of the government. Other wings contain the complete facilities of a modern country club, including: banquet halls, reception rooms, shops, game rooms, a dance patio, picture gallery, and theater as well as a well-equipped bar.

While architecturally the buildings do not present a unified style, they feature some noteworthy architectural aluminum details. Particularly neat uses of the metal are the aluminum mesh screen divider wall along the main reception room and the long row of smooth, bright pipe columns, seen in the photos at left. In other uses which include window sash, sliding glass doors, door frames, grilles, railings and jalousies, aluminum demonstrates its ability to establish a happy relationship with traditional building materials. The material used as facing on the mullions and spandrels of hotel-apartment wing consists of integrally colored, terra cotta tile sections.

## OWENS-CORNING FIBERGLAS CORP. SALES OFFICE

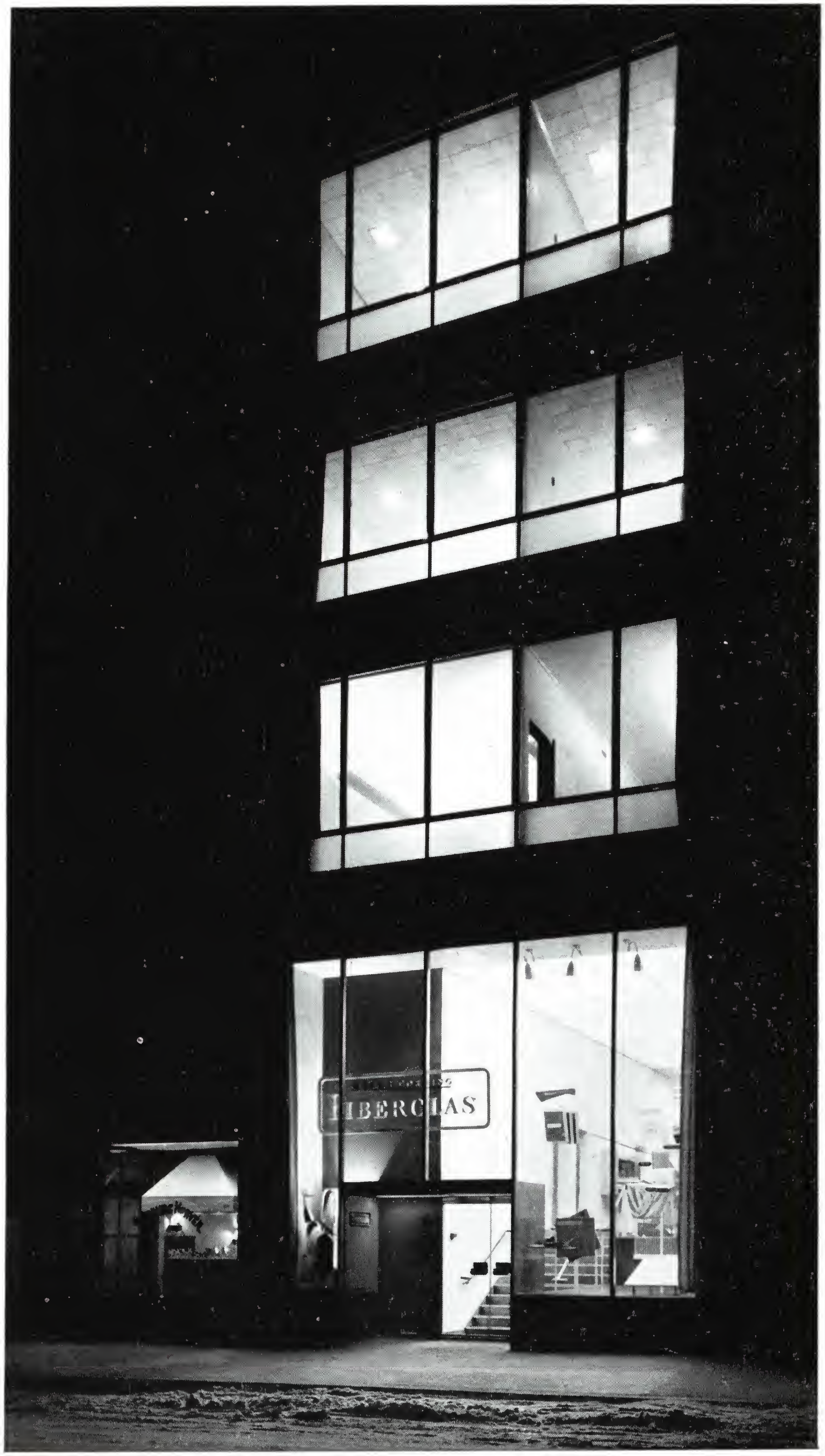
New York, New York 1948

Skidmore, Owings & Merrill

Gordon Bunshaft, *Partner in Charge*

Imagination, combined with deft handling of materials, transformed this adequate, but commonplace old New York brownstone into a remarkably attractive building. Special effort was made to incorporate many of the client's products throughout the building, such as acoustical, insulating and decorative materials. The first story and a half is allotted to display space which is entered from the street. The 18′ display window features 0.064″ aluminum cover plate at sides and ceiling to brilliantly complement the glass and glass products.

The upper three stories, containing offices and conference space, utilize aluminum sash in the front with 0.125″ sheet aluminum stools. In some of the offices a novel wall facing was installed which proved to be aesthetically pleasing, yet easily maintained. It consists of expanded or perforated aluminum sheets, 3′ wide, staple-tacked to a backing of stiff, parchment-like Fiberglas mat. Behind the mats are 3″-thick Fiberglas batts, providing insulation.




*Luminous ceiling, left, in first floor reception and display area is plasticized Fiberglas mats hung from a suspended aluminum grid. Fluorescent tubes with aluminum louvers light the entrance doors from above.*

*The new windows play an important part in the neat remodeling of this 19th century brownstone into modern office-display space. Two-story, glass and aluminum display window at ground level is especially effective.*

# KLOTEN-ZURICH INTERCONTINENTAL AIRPORT BUILDING

Zurich, Switzerland 1951/53

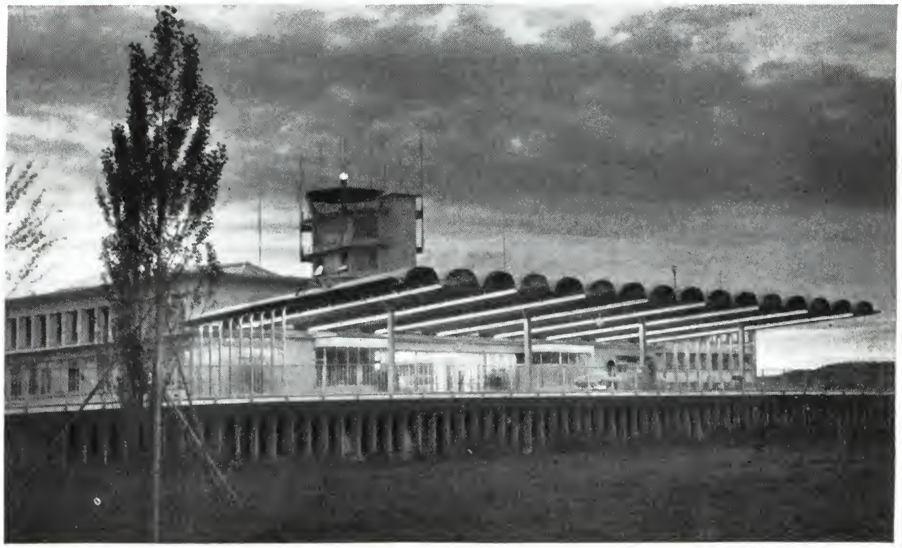
Alfred & Heinrich Oeschger

Passengers entering the new Zurich Air Terminal do so under a dramatically cantilevered aluminum umbrella that projects out at the front nearly 20′ from thin supporting columns.

To realize this effective structure, the architects borrowed two principles from the aircraft industry: first, the use of light-weight metals to achieve maximum performance with minimum loads and second, the advantage of strength inherent in corrugated sheet materials. Both applications seem particularly appropriate in an air terminal.

The projecting canopy consists of 16 trough-shaped arches, each more than 50′ long, each linked to its neighbors through its steel framework, the whole supported on the four steel posts. The skeleton is covered and further strengthened by a light skin of corrugated aluminum sheet.

Remainder of the building repeats the aircraft motif in the slim line details of its aluminum window mullions and in its window and door frames.



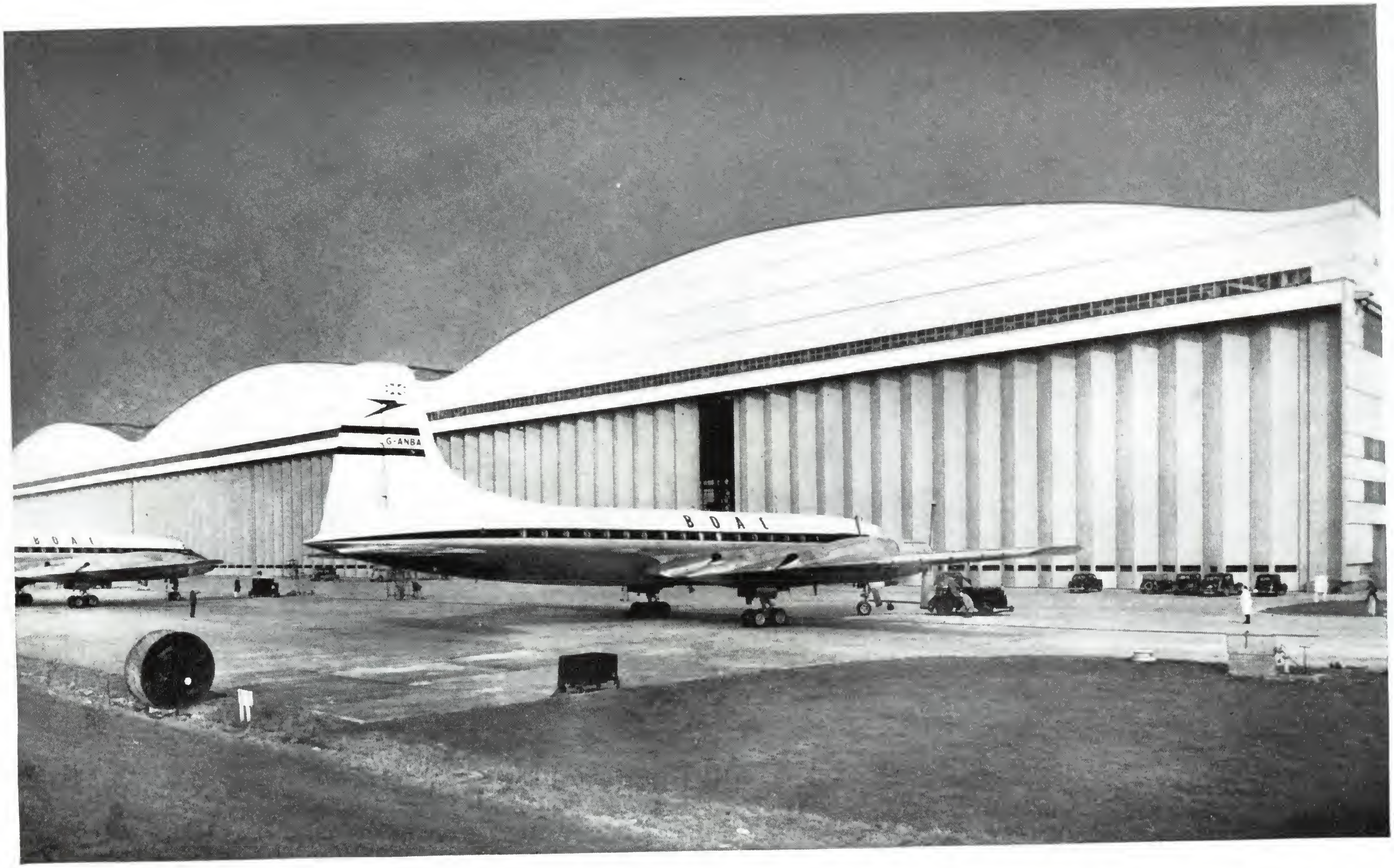
*Looming cantilevers of the light-weight structure, at left, make appropriately inspired entrance to an air terminal. Aluminum made possible light column supports.*

*Zurich's new terminal building, seen in two views at right, is an excellent example of a European pavilion-style air terminal using combination of concrete, aluminum and glass with unassuming but rare precision.*

# BRISTOL AIRCRAFT ASSEMBLY HALL

Filton, England 1949

Eric Ross



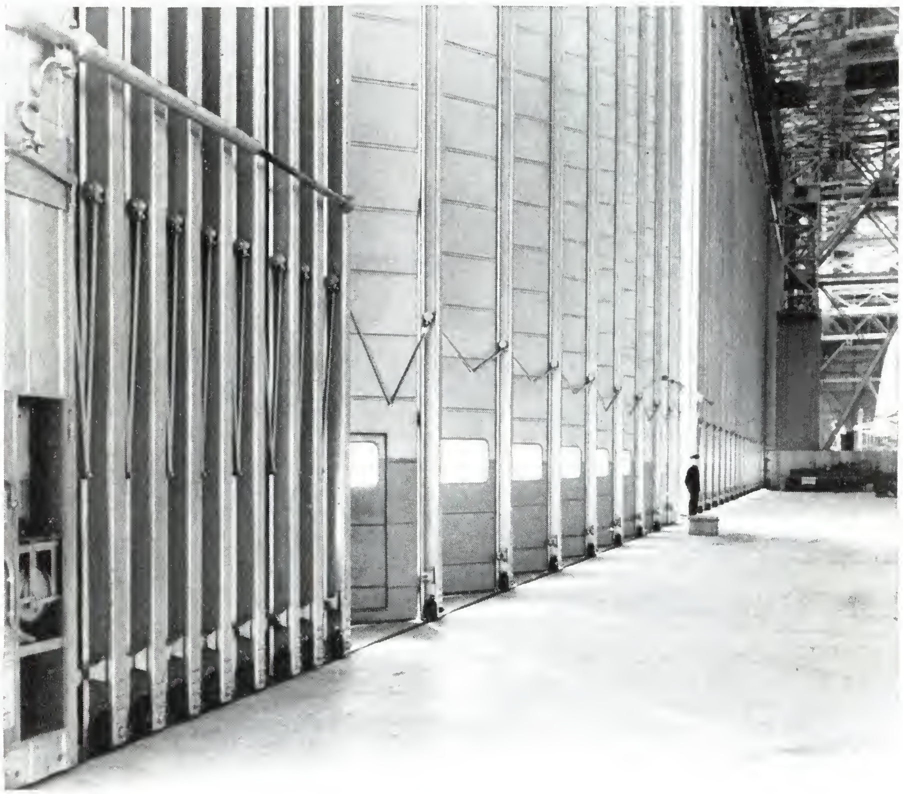
*Looking like huge-scale corrugations when closed, these aluminum sliding-folding doors can open the whole end of this plant in two minutes.*

Sheer size can create colossal problems. For instance, consider the question of doors that must be built to swallow or disgorge aircraft with wingspreads up to 300′, and to be quick about it. This was one of the problems that faced the architect of this vast envelope for fabricating, assembling, servicing and testing British planes.

The entire front of the huge three-bay hall is doorway, with probably the largest doors in the world. Set in pairs, two doors to a bay, they run for 1, 045′, a distance 25′ longer than the Queen Mary. They open as three huge maws, each 65′ high, 330′ wide. Yet a 3 hp. motor opens each door in 2 minutes, or the towering panels can be moved by hand.

Lightness and strength were prime considerations, of course; resistance to corrosion was almost as important. Hence the doors are entirely of aluminum. The 4½″ thick panels are formed of extruded aluminum structural sections, clad with pressed aluminum sheeting. The panels are joined together with cast aluminum hinges and are carried on 96 sliding extruded aluminum pilasters, each a sturdy 8¾″ x 9¾″ thick. Weight of this whole aluminum mechanized building front is only 200 tons.

The opposite wall of the shed is a window on the same gigantic scale—1,000′ long, 50′ high. Together with the skylights it gives sufficient light for detailed technical operations. The skylights and this great window wall are framed with aluminum.

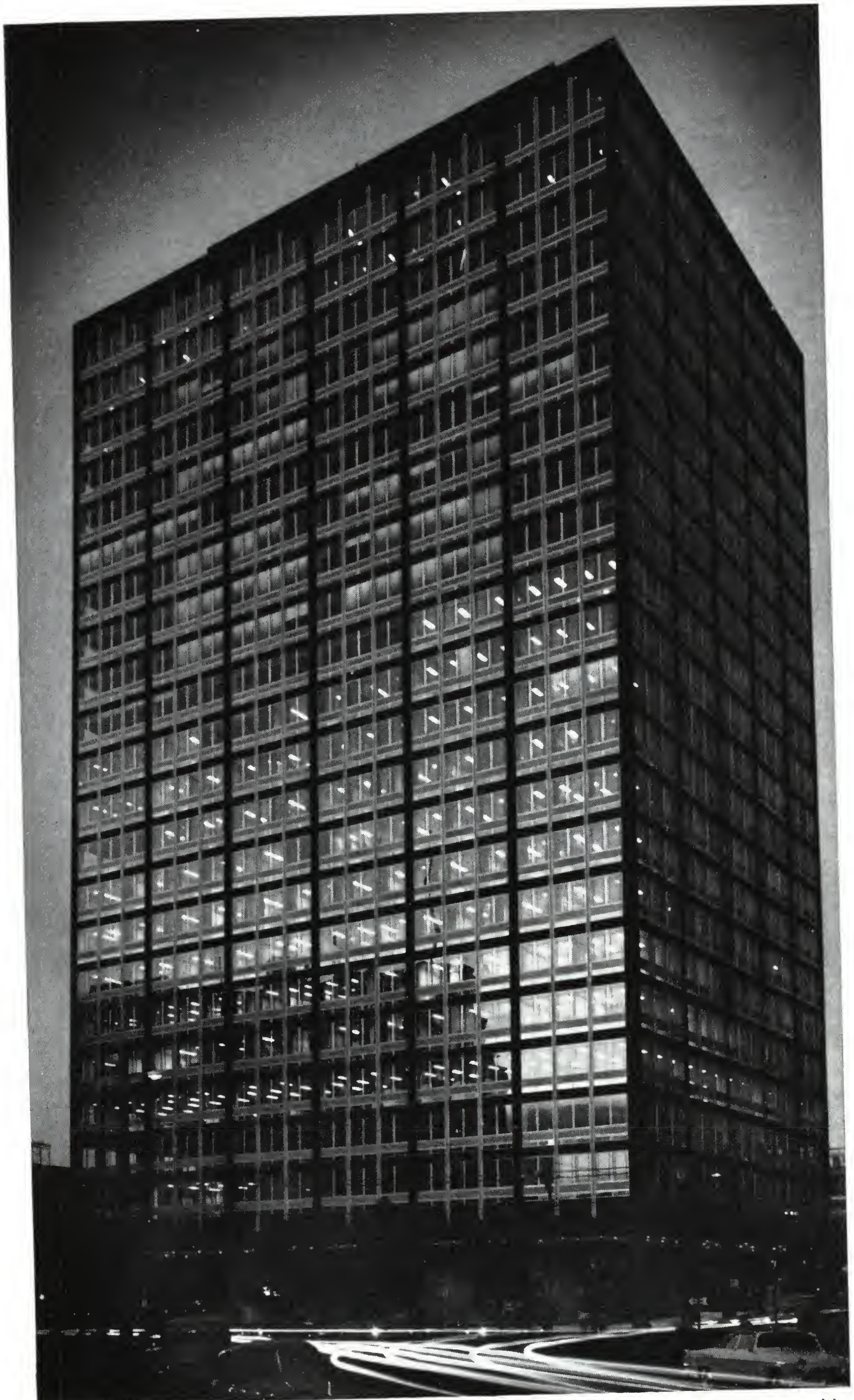


*The great arches of the roof, banded by aluminum-frame skylights, shelter eight acres of floor space. The giant aluminum doors are so light in weight and delicately balanced, they can even be moved by hand.*

## MILE HIGH CENTER

Denver, Colorado 1955

I. M. Pei



*By night ribbons of glass dominate, by day porcelain and cast aluminum grids.*

Here is a building that expresses in its outer wall not only its structure, but also its heating and cooling system. The subtlety with which these elements are played against one another and against the glass produces a splendidly rich exterior which might well be compared to the intricate pattern of a modern tapestry.

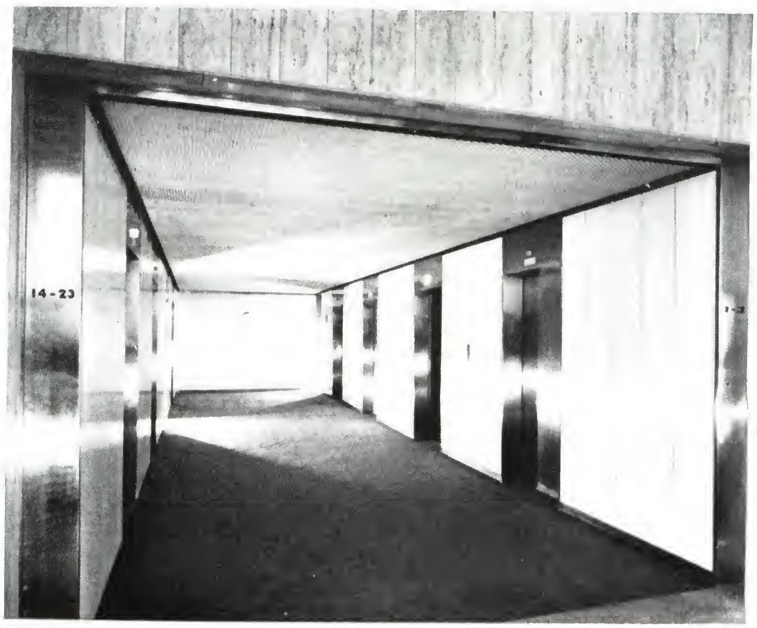
The dark threads of the wall are the columns and spandrel beams, handsomely set off with deep gray cast aluminum cover plates. The wall's lighter threads, of off-white porcelain enamel, show the horizontal window heating and cooling units, and the vertical high velocity air ducts that supply the units. The lightest threads of all are the off-white mullions between each two fixed panes.

Perhaps the most unusual and imaginative element in this design—the stroke that makes this curtain wall visually a curtain by night as well as by day—is the horizontal separation of spandrel and window mechanical unit by a 1′ ribbon of glass. Finishing off the wall at top and bottom are broad aluminum bands concealing the mechanical areas.

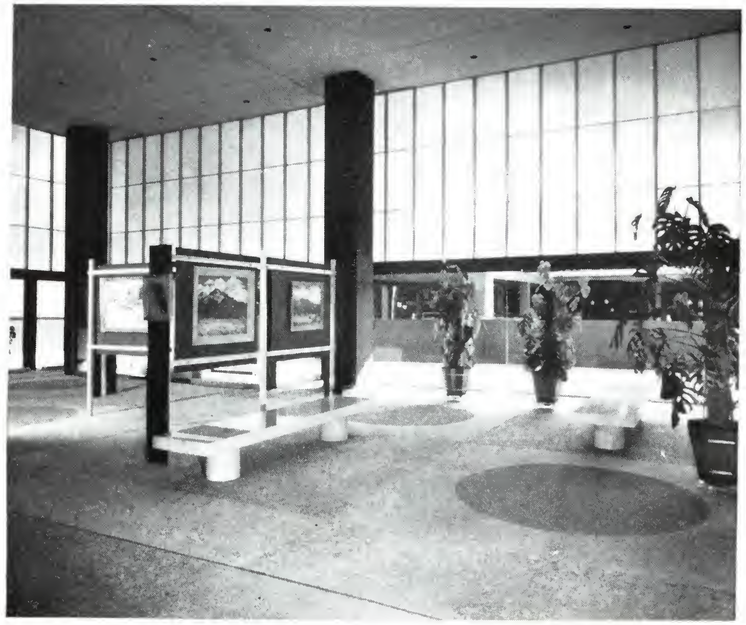
*At the ground level the building contains only a recessed lobby. On its main street side, shown above, it stands well back from the sidewalk line, and on all four sides an outdoor promenade flows underneath it.*

*Corner office view shows how the curtain wall grid appears from inside, with column at the corner, air risers to either side. Note the low window at the floor line. Hung ceiling covers the spandrels.*

*All passenger elevators are in two facing banks. Textured aluminum ceiling panels add note of relief to otherwise smooth, polished surfaces. Mechanical core is offset toward one end of first floor area.*




*Lobby has textured and patterned terrazzo floor, translucent panes above clear glass. Mile High Center includes two other smaller buildings, a bank and a one-story airlines terminal with restaurant below.*



# STATLER HOTEL

Hartford, Connecticut 1955

William B. Tabler

Developed by the Hotels Statler Corp. as a small-city prototype, this 455-room hotel is the product of eight years of intensive study by the owning company and its architectural staff.

The structure is enclosed by the lightest curtain wall ever at that time used for a tall downtown building. The 2″ curtain wall weighs only 10 lbs. per sq. ft., and this light weight makes possible the deep cantilever of the building's tower above the first floor, 14½′ on one side, 10′ on the other.

Most of the rooms overlook a large public park. The carefully studied wall provides clear glass across two-thirds of the wall of each guest room. Set in aluminum frames, the large windows are locked shut, but swing open for inside cleaning. Two vents are provided at the bottom of the casement which can be opened by guests, consequently the air-conditioning system is designed to allow for the occupant's occasional wish for direct access to outdoor air.

*Wall, shown right, is designed with a three unit bay enclosed in aluminum facing. The center is porcelain enameled steel panel backed by glass fiber, asbestos cement and sealed with an aluminum foil vapor barrier.*

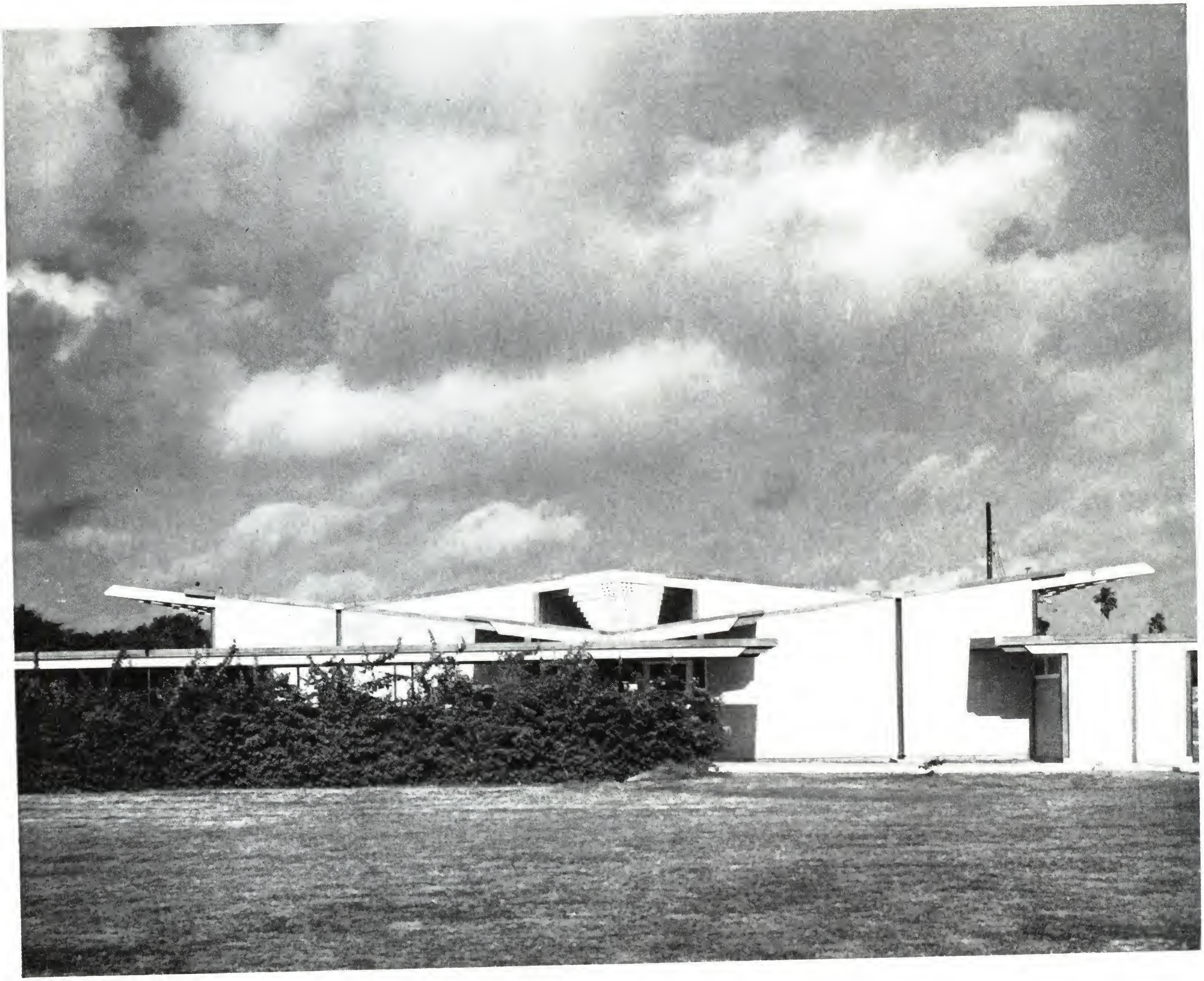
*Aluminum-faced columns and spandrel beams of building have a minute fluting that gives the aluminum a subdued lustre, left above. Name uses aluminum letters.*

*Easy flights of stairs like these in the lobby were carefully placed throughout plan with the knowledge that promenading hotel guests often prefer to walk.*

# CROCKETT ELEMENTARY SCHOOL

Harlingen, Texas 1950

Cocke, Bowman & York



On the plains of the southwest a roof line is more than a shelter line. It is a landmark, a relief to the eye in the monotonous immensity of nature.

This ten-room elementary school on the Texas plains gives its pupils and their elders an interesting juxtaposition of architectural hill and valley, along with interior toplighting, good control of sky glare and sun, and a welcome to the breezes. The entrance, shown in view at left, is through glass doors which lead to central corridor. This corridor is open to the sky between large beams of wood.

The window-shading louvers—on the north side because of the reflected light from the sky and on the south to combat both glare and direct sun rays—are .054″ thick aluminum. They look heavier because they have a stiffening 1″ L bend at each long edge. Their design and detailing are worked out neatly: at the beam face, each louver is slipped into two ½″ slotted pins, which slip into holes drilled in the beam. A ⅛″ pin dropped through the larger pin at right angles to louver holds the aluminum sheet securely within its slot, although easily detached.

*Roof line, left, terminates in 7′3″-wide horizontal sunshade with aluminum louvers. High roofed portion of the school has corridor skylight with fluorescent light troughs below. Center entrance is at corridor's end.*

*Aluminum louvers are held in slots by pins. Louvers have a 1″ L bend for additional rigidity at each long edge, which gives them an elongated Z cross-section.*

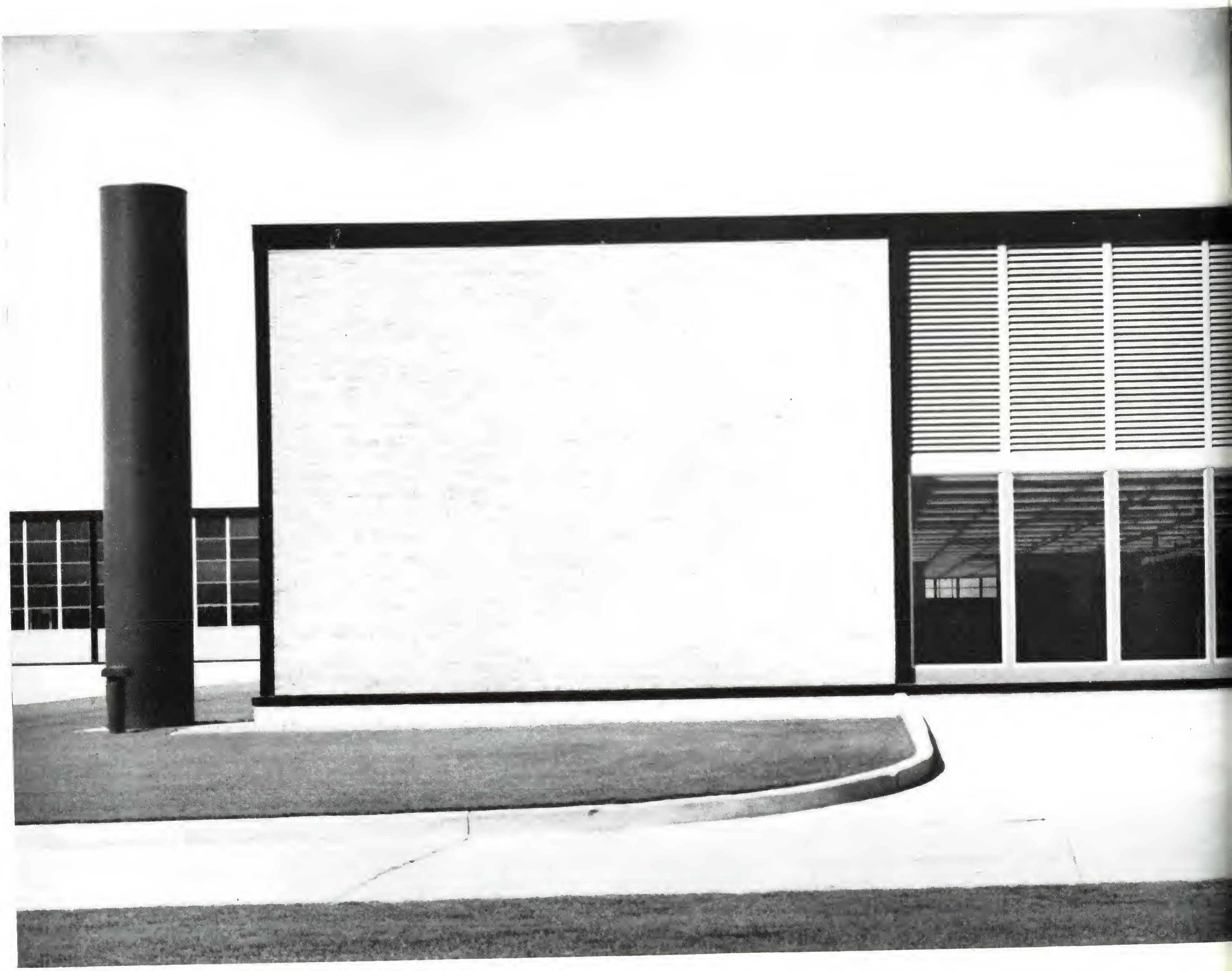
# GENERAL MOTORS TECHNICAL CENTER

Detroit, Michigan 1951–55

Eero Saarinen

A culture builds its successful monuments to the ideas it loves, the ideas that are its life-blood. It is only to eyes in later times that great monuments represent a strange or a peripheral interest. Critics who complain that we have lost the art of building successful monuments have simply missed Eero Saarinen's General Motors Technical Center.

Here is a mile-square research center—analogous to a campus—that is very possibly one of the true monuments of our age. Of course, it is built for prac-



tical use, housing a coordinated group of laboratories, offices and workshops. But it also boldly symbolizes and celebrates the whole idea of American technical progress.

Some of the qualities that make it so expressive of its age and its premise are:

Automobile-age scale: it is meant to be seen as a whole from a moving car, not explored on foot.

Industrial materials: gleaming walls of aluminum, glass and porcelain enamel are set off by vividly colored walls of ceramic glazed, sand molded shale brick.

Machine precision: its beauty is of the machine-made—the finish of aluminum strips, enamel panels.

Another quality significant in a contemporary monument: the amenities are not turned outward to impress the outsider. The landscaping, fountains, parks and pools are aimed inward to the employees.

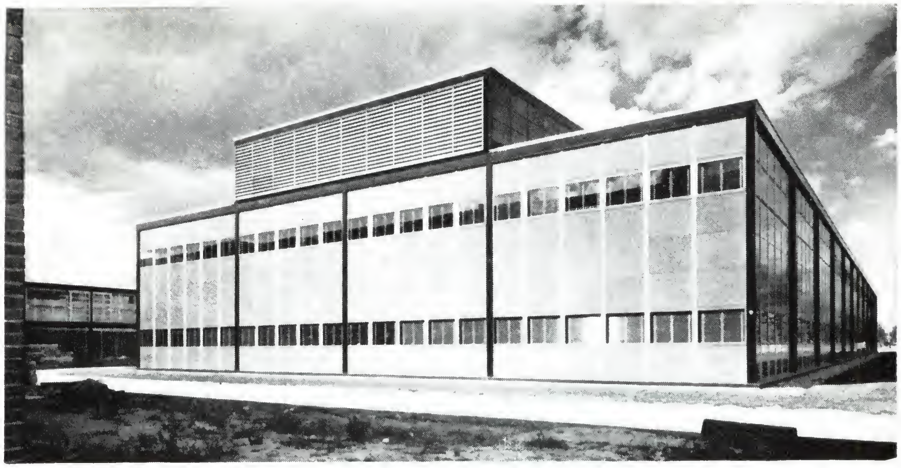
*Dynamometer Building is used to test automobile engines. Stacks, at left and right, expel exhaust gases.*

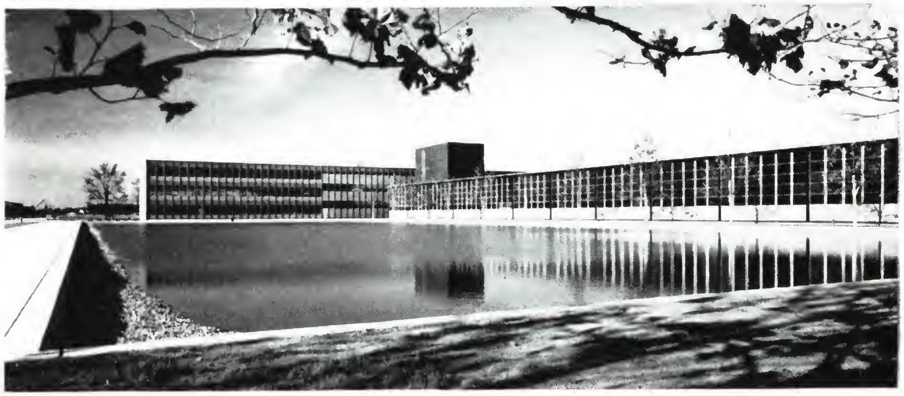
The walls of the technical center buildings became an important technical research project themselves. Over the four years that the center has been building, the wall panels have been constantly restudied and improved. Results are already being used in many other buildings throughout the country.

The porcelain enamel panels at first gave trouble from bulging and delamination. New glues, new metal clips and different insulating materials helped solve the problems. The latest answer of the researchers is the use of aluminum, rather than steel-faced panels. The reason: both surfaces of a steel sheet must be fired with porcelain enamel or the unequal surface tension causes warp. But aluminum, which requires an enamel coat only a third as thick as that for steel, need be fired only on the exterior, leaving a good gluing surface inside.

Other advantages of aluminum panels are their workability and corrosion resistance. A porcelain enameled aluminum sheet can be roller-leveled. It can be drilled or cut without spalling, and the metal newly exposed will not be harmed by corrosion. Although enameling of aluminum sheet adds only 10% to weight and 6% to thickness, it increases flexural strength and resistance to denting by 60%.

Another big challenge at General Motors was provision of a seal between the aluminum framing and the fixed double-glass or porcelain panels. Caulking, after its volatile ingredients dried, would not adhere well to the slick glass or enamel surfaces. After extensive research and experimentation, a mechanical sealing gasket of neoprene was developed which is estimated to have at least a 25-year life. It can be "unzipped" to remove a pane or panel from its aluminum frame when replacement is necessary.





*Elegant detailing of aluminum strips, enameled panels and structural steel shows in the three views, at right. The south face of the mechanical research unit is at top, engineering offices and shops bordering pool, center, and close-up of the engineering office, bottom. Blue-black exhaust stacks, at left, form monumental colonnade effect alongside of Dynamometer Building.*

# DUCHEN BISCUIT FACTORY

São Paulo, Brazil 1953

Oscar Niemeyer

The uninterrupted length of this baking plant is an imaginative and logical enclosure for the nearly 1000′ "assembly line" bakery facilities. The first building of a whole group of food processing plants, it consists of two parallel wings with a narrow well between them. In this building, Brazil's master architect has accented good lighting, ventilation and production efficiency. Structurally, it is made up of reinforced concrete rigid frames 32.8′ o.c. with hinged columns that are exposed on the

exterior. The unusual shape of the frames with their inward slanting legs places the windows at such an angle vertically as to avoid most of the glare from the bright sky.

The light corrugated aluminum roof rests on a system of reinforced concrete girders. The reflective properties of the roof make additional insulation unnecessary; in the interior, the exposed aluminum roofing with its bright reflecting surface increases the level of illumination throughout the plant.

*This sleek plant with reinforced concrete rigid frames and corrugated aluminum roof is located on broad, landscaped site near city of São Paulo. In addition to offices, plant has complete restaurant, exhibition hall, swimming pool and game room for use of employees.*

*Free-form masonry canopy, at left, encloses game room and restaurant, also provides sheltered walkway between the road and plant. End of the canopy leads to a basement locker room and first aid station.*

*The tunnel-like interior of plant, at right, has longitudinal and transverse system of reinforced concrete girders supported by rigid frames. Continuous fluorescent strip lighting and aluminum roofing, left exposed, add brightness to plant interior on dark days.*

# ALCOA BUILDING

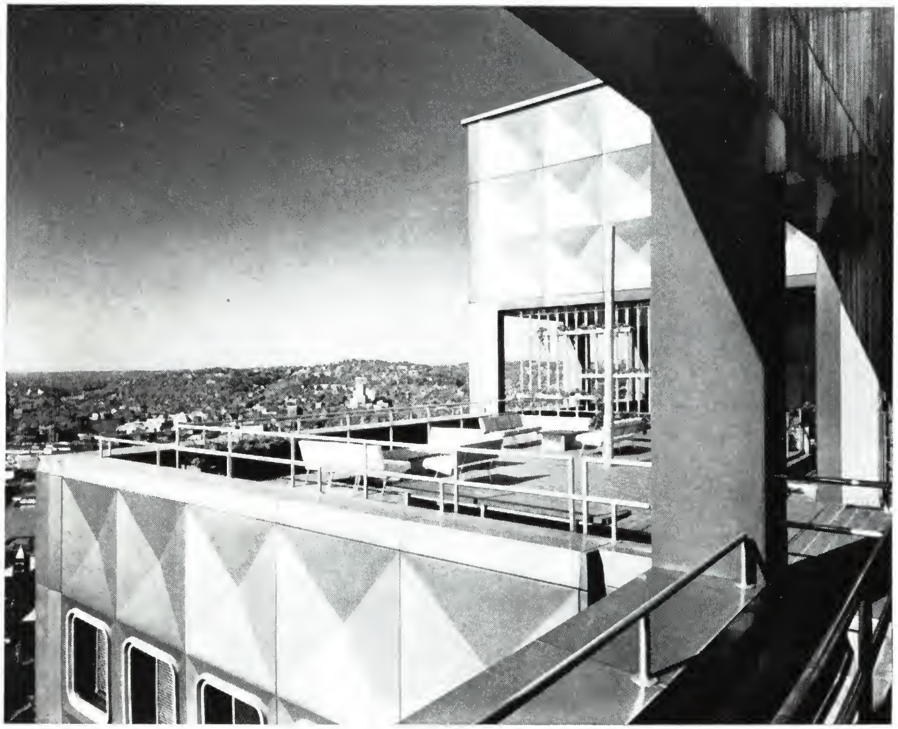
Pittsburgh, Pennsylvania 1953

Harrison & Abramovitz

This 30-story demonstration of architectural aluminum will undoubtedly find its place in history books as the first daring expression of the metal curtain wall. Just as the United Nations Secretariat Building by the same architects started a new era of glass-walled office buildings, the Alcoa building is being followed by a family of structures clad in faceted aluminum or steel—such giants as the Republic National Bank building in Dallas (p. 48) and the Socony-Vacuum building in New York.

It indicated that the nature of aluminum as a building material is far different from others: it is light, cutting structural steel requirements by as much as 30% to 50%; it is easily prefabricated into tall panels which can be swung quickly into place without need for scaffolding; it can be stamped into patterns, which not only give added strength but introduce textures to building, reminiscent of the rich stonework of other eras. At the same time, it is capable of new colors, new variety of effects with the changing position of the sun or observer. Understandably, the building was designed as an aluminum showcase. Its reversible rubber-rimmed windows, radiant acoustical ceilings, slotted lath as well as the plumbing, wiring, ducts, and hardware were here made of aluminum to demonstrate the many wide architectural practicalities of this metal.

*In this view, the faceted aluminum panels of the Alcoa tower, stamped in an inverted-pyramid pattern, brilliantly reflect sunlight. At right is the German Evangelical church, whose lacy steeple was, in 1927, Pittsburgh's first known example of architectural aluminum.*



*Executive penthouse and terrace, above, are furnished with contemporary furniture framed in strong aluminum. At the lower left can be seen the aluminum windows, which are cleaned from the inside by deflating their rubber gaskets and pivoting the sash.*

*Main entrance lobby, left, is a "bird-cage" structure four and one-half stories high, suspended from two cantilevered girders as a demonstration of the metal's light weight. Versatile aluminum is also used for mullion covers, doors, trim, and marble floor stripping.*

# HEMISPHERICAL MEETING HALL

Longview, Texas 1953

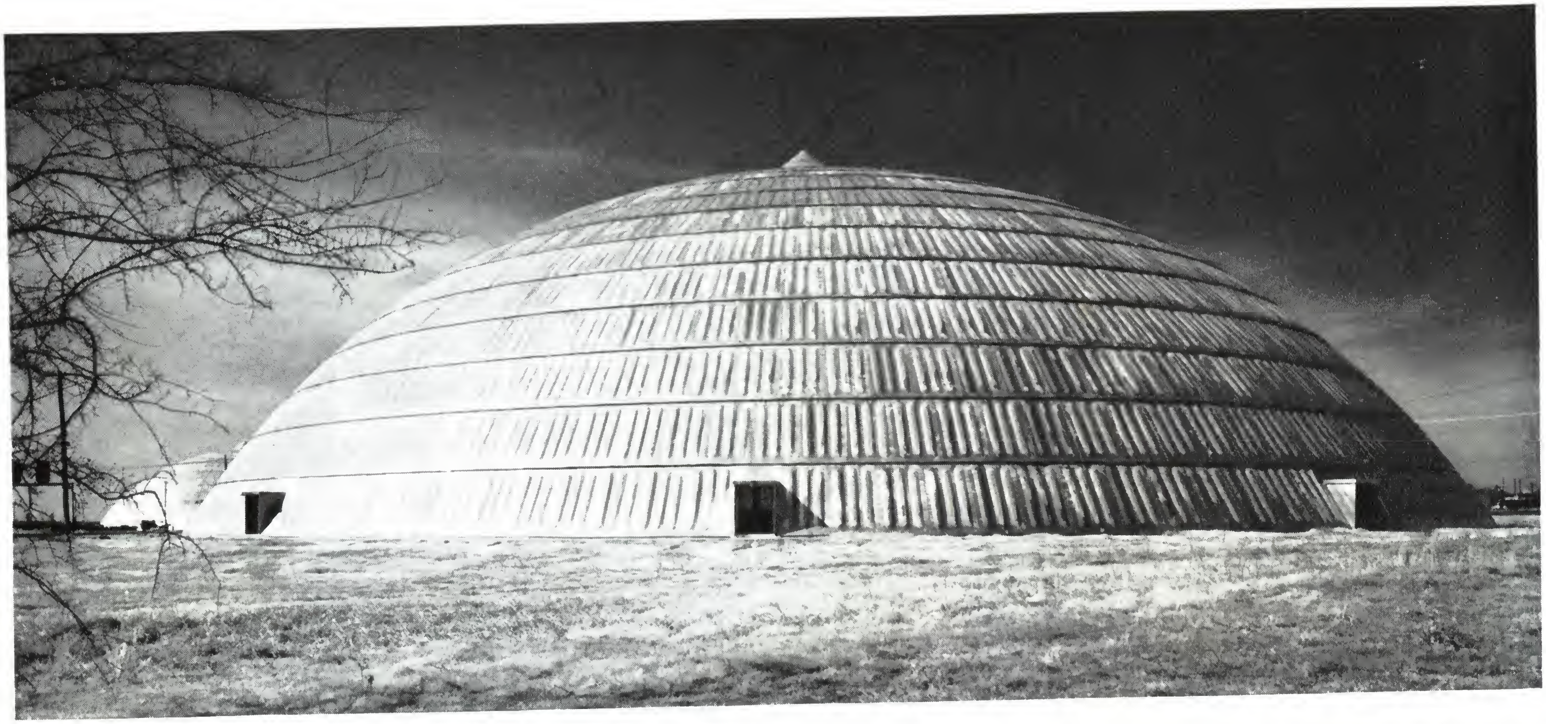
R. G. LeTourneau Co., Inc.

For a long time engineers have greatly admired the egg, a creation whose framing and skin are one.

This 12,000-seat aluminum meeting hall is all skin. Its central mast — once it has served its function as a support during erection — can be pulled out with the skin standing smug as an egg, in even an 80-mile-an-hour gale.

The enormous hall, 94′ high and 300′ in diameter, is made entirely of 1,200 aluminum plates bolted into concentric rings. Erection started with bolting together the smallest ring at the foot of the mast. Then as each successive ring was put in place, the completed portion was hoisted higher up the mast. The final ring was bolted to a foundation. Perhaps it is not quite accurate to say there is no framing; for each aluminum plate has three parallel corrugations and in effect these manipulations of the skin are the structural ribs. Actually, in this particular auditorium the mast was left in. Here it is used not only to support a cluster of lights but the tiptop ventilating cone as well.

Despite its uniqueness, the dome is no mere engineering stunt. It fills the requirement of an economical, quickly built auditorium with a tremendous area of wide-open space for evangelistic meetings.



*Huge, permanent aluminum auditorium was erected in only thirty days with a ten-man crew. The LeTourneau Co., which designed, fabricated and erected it, reports the skin was built for the amazingly low cost of $3.50 per sq. ft. of enclosed space.*

*Inside, for acoustic control, glass fiber battens are hung from each concentric ring of aluminum plates. The mast holds the powerful lighting.*

*Ribbed aluminum overlapping plates are 0.125" thick, weigh only 4½ lbs. per sq. ft. of area covered. This is one of the world's lightest domes.*

# PAN AMERICAN LIFE INSURANCE OFFICE

New Orleans, Louisiana 1950

Skidmore, Owings & Merrill and Claude E. Hooton

*Company offices are in the louvered main wing. The rear extension, at right in photo, houses services such as printshop and kitchen at ground floor level; at second floor level a cafeteria-auditorium and executive dining quarters face into an interior patio. The entire building is air conditioned.*

Though it is easy to see the difference between this modern louvered facade and the traditional shaded balconies of old New Orleans, they have a great deal in common: both are architectural means to cope with the heat of this delta region.

All four sides of the four-floor central office mass are shaded by aluminum vertical fins set into a cantilevered concrete framework. Because the main wing itself is oriented on the diagonal—with the long sides facing northeast and southwest—the fins are at right angles to the walls. The louvered effect is light and lacy.

There is nothing picayune about these fins, however. Of 0.102″ aluminum, they are 13′ tall, protecting both window and spandrel, and 2′–6″ deep. They stand 2′–8″ out from the wall line. The exterior edges are flush with the aluminum-faced edging of the cantilevered floor slabs.

One reason this building receives such careful sun protection is that it is fully air conditioned. It is an excellent example of the ironic architectural effect of modern air conditioning. Buildings with the most complete air-cooling equipment invariably enjoy the most efficient protection from the sun.

*Protecting the slab from sun on all four sides and reducing air-conditioning costs are tiers of 13′ high aluminum louvers set into aluminum-edged concrete floor slabs. View shows main entrance at first floor level.*

# BRISTOL PRIMARY SCHOOL

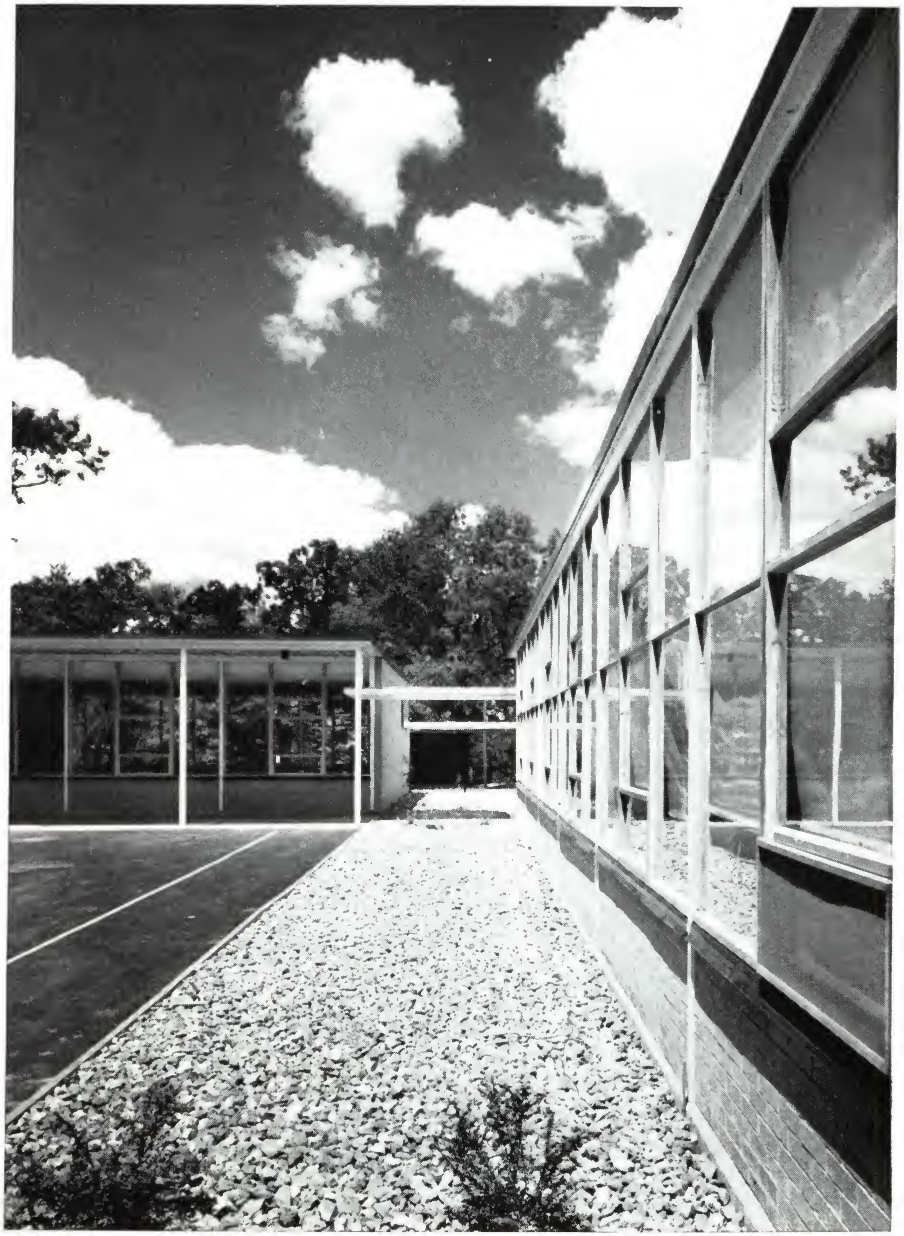
Webster Groves, Missouri 1955

Hellmuth, Obata & Kassabaum

Expanding school populations invariably pose the problem of adding to existing structures or developing a completely new site. The happy solution in this progressive St. Louis suburban community was a densely wooded site directly across the street from the existing school. This made possible the grouping of all lower grades in the new school with upper grades within easy reach in the old building.

Materials were carefully chosen for utility as well as attractiveness. Light structural steel was used for the frame and left exposed in several outdoor covered areas to add dark accents. End cavity walls are 10″ thick, of pink brick exposed both inside and out. Window wall sash are aluminum throughout, as well as the skylight frames.

The floor plan consists of two units, one of four classrooms grouped around a multi-purpose room, the other a two-room kindergarten. The units are connected by a roofed passageway. During bad weather, the multi-purpose room serves as a play area.



*Meticulous design of school building carries through even to the raised nameplate on end wall, at left. Besides classrooms, the larger unit contains office, lounge, health room and community meeting room. School received top award in national school competition.*

*Close-up of aluminum and glass window wall shows passage from main classroom unit to kindergarten. Classrooms are self-contained, having their own toilet rooms, coatrooms, storage areas and outside entrances.*

## VILLA IN SAINT-CLAIR

St. Clair (Var), France 1949

Henri Prouvé and Jean Prouvé

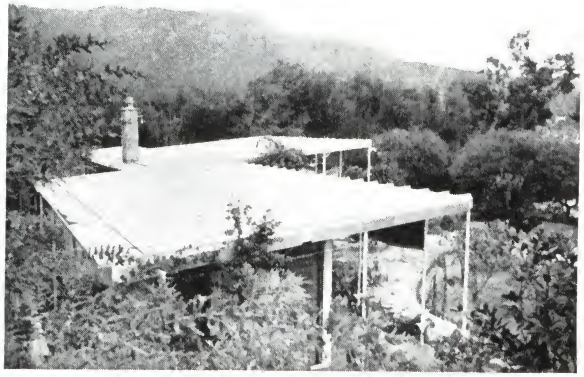
One of the most important factors in the design of prefabricated houses is the weight of wall, floor and roof panels. Panels that are too heavy for two men to lift can spell defeat to the entire prefab operation.

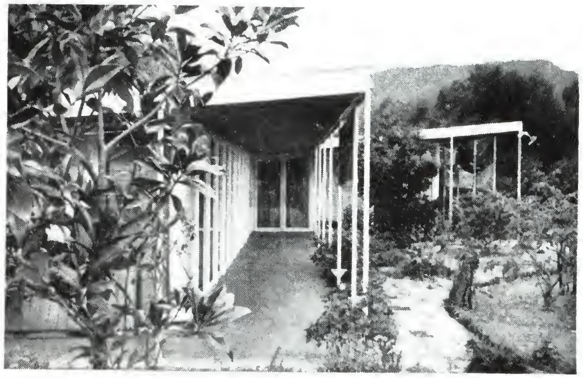
That is why this aluminum prefab house makes so much sense. Its framing is steel, but its insulation, its wall surfaces, its roof and floor decks, and its windows and doors are of aluminum. As a result the total weight of this house is about 1/3 that of an equivalent structure built of wood and masonry. This prefabrication system was developed in France over a 25-year period of experimentation by the Prouvé brothers. All panels conform to a one-meter module, and there are five basic wall panel types: a blank wall, a wall with a window, a floor-to-ceiling glass unit, a door panel (with pre-hung door), and a ventilation panel with large, circular perforations.

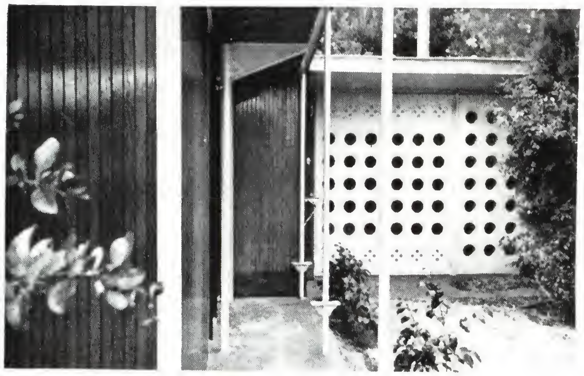
Exterior wall surfaces were finished with lacquers of different colors, while the reflecting qualities of the aluminum were exploited in the roof decks. Both floor and roof panels are hollow and form plenum chambers for the distribution of warm or cool air for around-the-season heating or air conditioning.

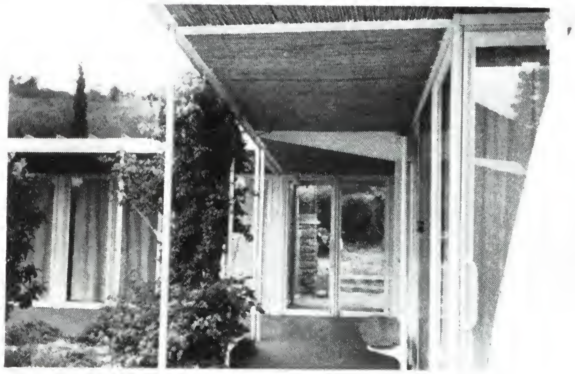
*Terrace around periphery of vacation house in south France is protected by an aluminum canopy supported on a pipe frame. Glass door panels shown here are standard, were designed to fit into one-meter module.*

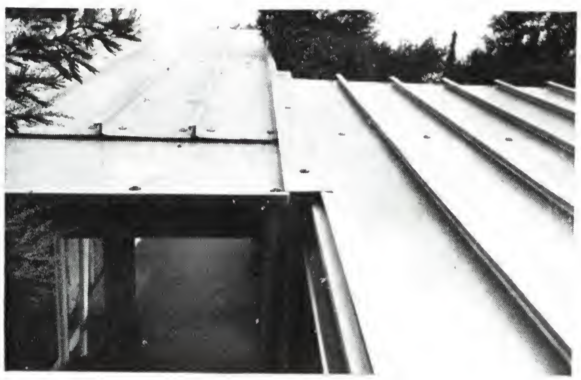
*Pictures below show different details of prefabricated aluminum vacation house—e.g.: crimped aluminum roof deck where reflecting surface is of great insulating value; terrace detail with light, aluminum pipe columns; close-up of perforated ventilation panels on one side of house (small holes are ventilators, large holes serve as windows); detail of covered link connecting daytime and nighttime wings of house; a close-up of roof deck; and a detail of aluminum gutter and down-spout. The house shown on these pages was designed as a special model for a vacation site. Models for temperate as well as very hot climates have also been designed and produced by Prouvé brothers.*











This small office building—occupied by the insurance company owner and one tenant—is notable for its skillful design relationship of large masses as well as for its feeling of openness and simplicity. Its chief design feature—the 17′-high aluminum brise soleil across the entrance facade—has been used simultaneously for a strictly functional purpose and for a decorative highlight as well.

The movable vertical aluminum louvers protect the big 7′ windows in second floor offices from the heat and glare of the morning sun. But the architect carried the louvers below the windows to cover the spandrel too, thereby simplifying the facade and emphasizing the openness of the building.

On the south facade, large glass areas are made practical by deep horizontal aluminum-louvered overhangs. These also convey an effect of generous, rhythmic mass combined with lightness. Inside, high-intensity ceiling lighting behind wall-to-wall eggcrate, in addition to the open planning in reception and generous office areas, fulfill the promise of handsome spaciousness conveyed by the exterior.

*At the right, a chief design feature of this California office building is its sweep of aluminum sunshades set into cantilevered frame. The two main areas of aluminum and glass abut on a corner "anchor" of brick.*

*Horizontal aluminum louvers, top left, protect offices on the south face of the building from glare and heat.*

*Effect of vertical louvers on the street side, left, is accented after dark by fluorescent lights at top, bottom.*

# NORTHWESTERN MUTUAL FIRE INSURANCE OFFICE

Los Angeles, California 1951

Richard J. Neutra


TUNNEL

# 100 PARK AVENUE OFFICE BUILDING

New York, New York 1951

Kahn & Jacobs

To a scholar making an architectural study of mid-century Manhattan, this building, on the site formerly occupied by the famous old Murray Hill Hotel, could well serve as a flattering example of upper-bracket, midtown office space. In spite of the fact that the architects had to work within a fundamentally ungraceful zoning envelope, it is an attractive building, both from the street and from the windows of neighboring skyscrapers. From the viewpoint of the builder, investor and tenant, it is an eminently practical building. It is perhaps its many carefully designed practicalities that are its most widely studied features.

Skyscraper walls often leak because of improper flashing or design. In this building, the wall surface between piers is composed of aluminum mullions, windows and fluted cast aluminum spandrels, all carefully designed to control leakage. For design purposes, the spandrels were partially oxidized beforehand; they make a pleasant contrast with the aluminum mullions which are protectively coated to maintain their pristine luster. The double-hung sash is also aluminum.

For greatest interior flexibility, bay widths are varied, with two, three, four, five and six windows all occurring at various places between piers. These variations, plus unusually deep bays on the Park Avenue side, provide exceptional planning freedom to the tenants, most of whom occupy entire floors.

*This simple exterior provides unusual interior flexibility. Bay widths are varied with two, three, four, five and six windows all occurring at various places between the piers, giving the tenants planning freedom.*


*Airy and luminous lobby ceiling, which can be glimpsed through the glass entrance, above, is formed of parallel aluminum curves along which the lighting is directed.*


The ingenious aluminum sunshade on this two-story store and office building accomplishes a great many things besides providing the building with an identifying feature. It completely shades the first floor store window glass from the sun at all times of year. It does the same for the second floor windows, and—because the louvers also cut skyglare—it permits a full face of glass on the upper story.

Architect John York reports that the sunshade cost less than a standard marquee. And because the steel framework is cantilevered out 10′ from 15′ inside the building, structural beams across the building front are materially decreased in size. Aluminum louvers are of 0.054″ sheet, locally fabricated in a Z shape. Pins, slipped through holes drilled in verticals, catch in the crotch of the Z; thus no bolting or welding is needed. Aluminum mullions repeat the 6′ vertical spacing of the frame which tends to unify the total design effect.

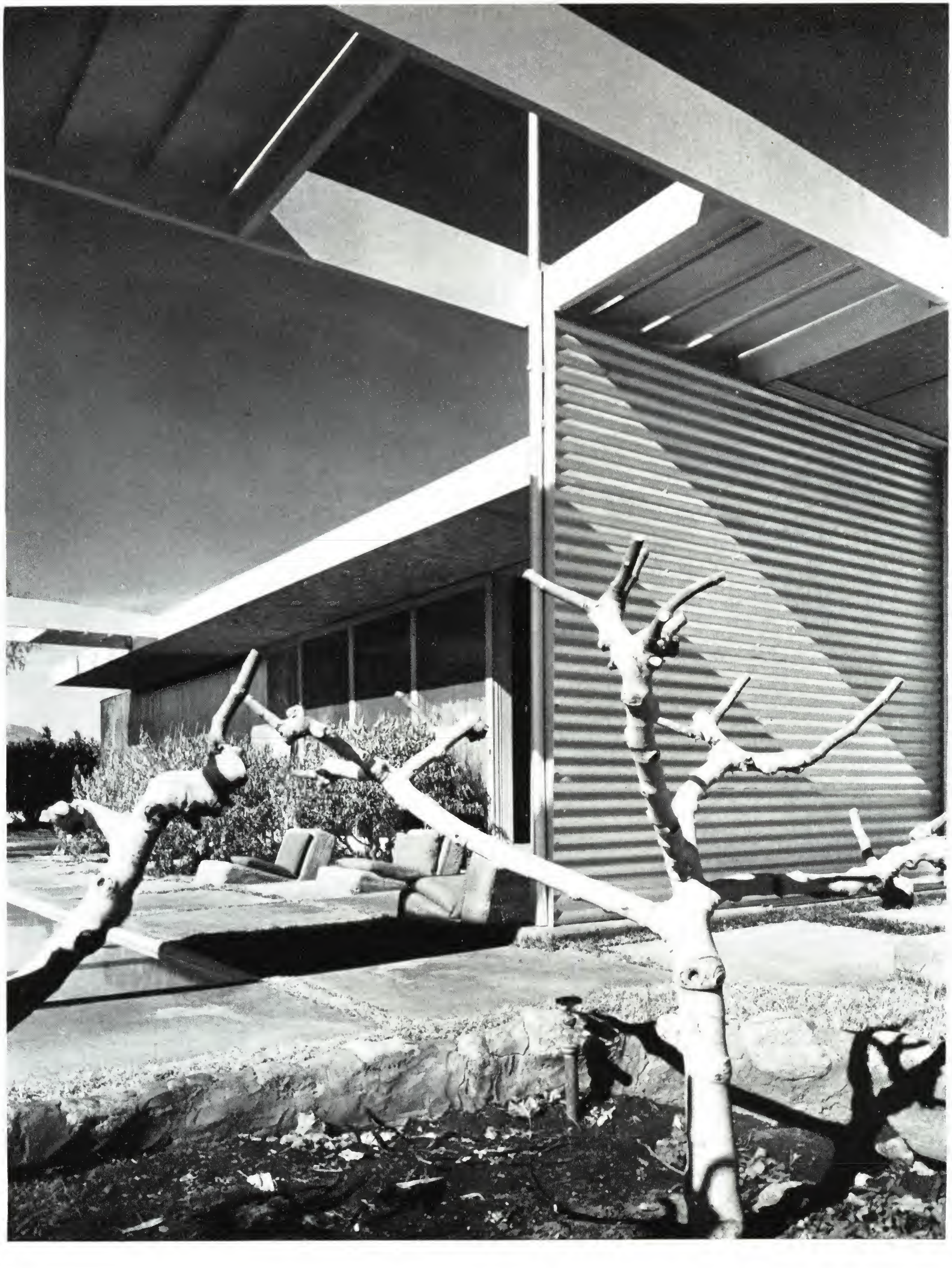
*At night, the aluminum louvered sunshade on this store-office building is converted into an outdoor lighting fixture and sign. Floodlights behind framework have been directed upward against the white ceiling.*

*Aluminum louvers protect the upper windows against sun and skyglare; their canopy effect shades store windows. Elevator lobby for offices is on the left; office equipment sales center occupies the rest of first floor.*

# CLARKE AND COURTS BUILDING

Harlingen, Texas 1951

Cocke, Bowman & York



# FREY RESIDENCE

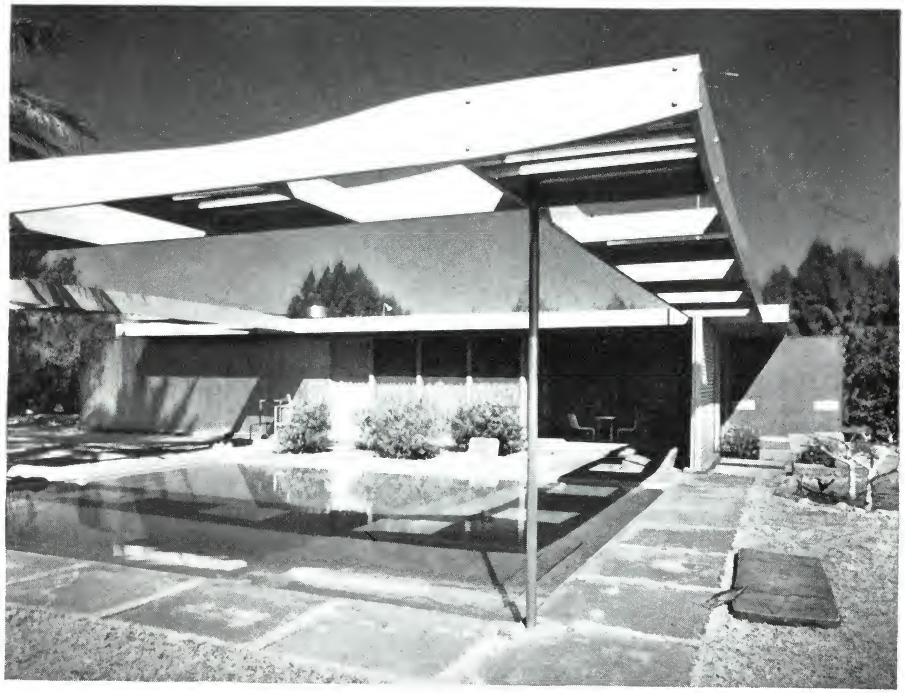
Palm Springs, California 1950

Clark & Frey

This luxurious year-round dwelling in the desert shows how graciously factory-produced materials and structural shapes can place a house in harmony with earth and rock.

Architect Albert Frey designed the three-room nucleus of the plan as an experimental model for a low-cost mass-produced house. Using it for his own home, he added an outdoor swimming pool and a spacious living-sleeping area. The living area is focused around a free-standing fireplace and another pool, partly indoors, leading by cool gray stepping stones to a solarium. The two pools help to cool and humidify the house, which is opened to the outer living space by sliding glass doors. Folding interior partitions also make it possible to use the interior of the house as a spacious whole or to seal off each functional unit.

Corrugated aluminum exterior walls and roof are used for economy and for their sun-reflecting property. The aluminum walls and ceiling are left unfinished on the interior, where they combine freely with such alternative wall treatments as lapped pine boards. Throughout the house, the light structural system and stock materials are given a luxury look by unusually skillful detailing.



*This aluminum house, left, opens to the outdoors and is related to its desert setting by extended framing.*

*Long low lines of house, above right, fit the flat desert site. Aluminum roof can be opened for view of sky.*

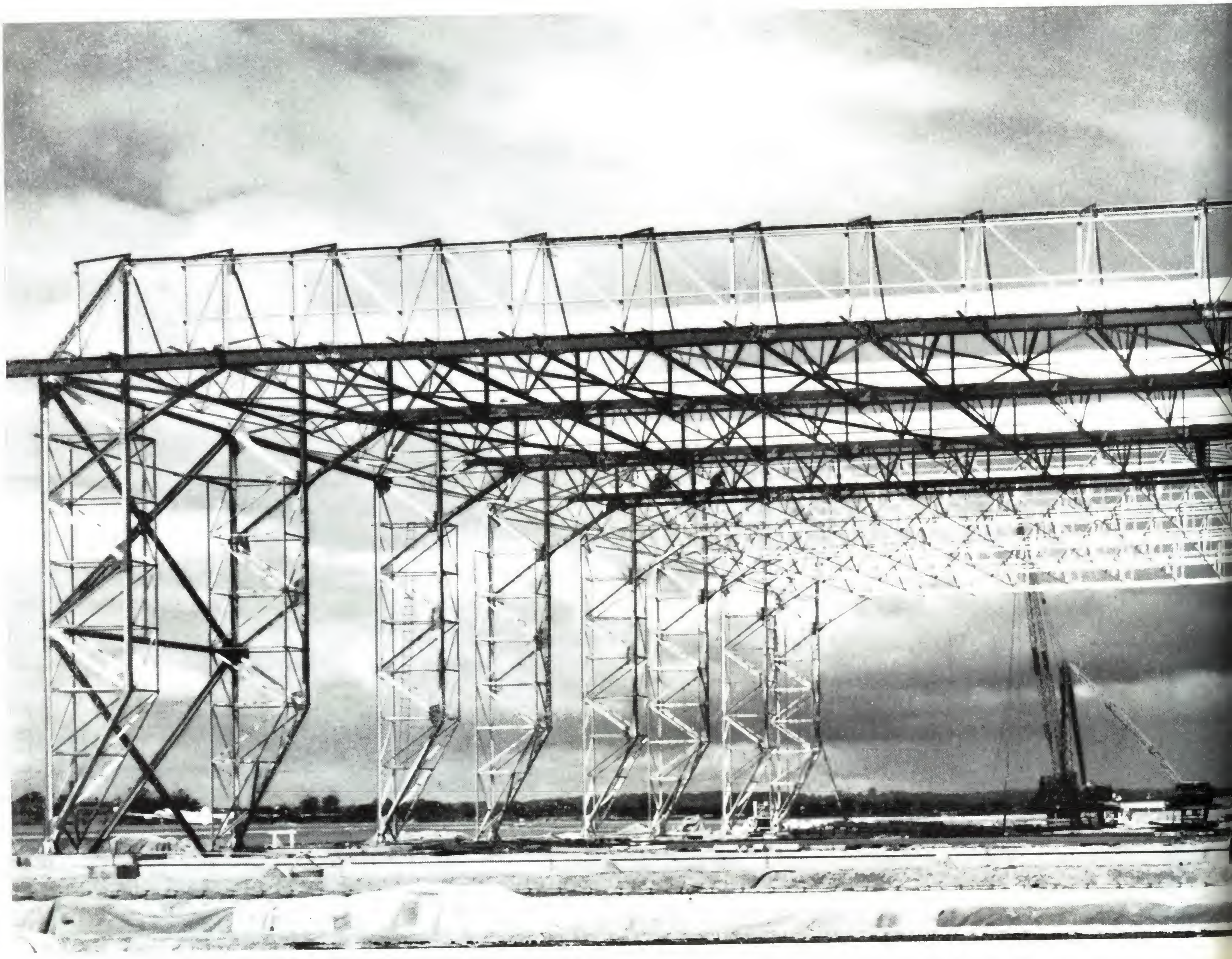
*Sliding wall links swimming-barbecue area to outdoor dining area, which merges with living-sleeping room.*

# DE HAVILLAND FLIGHT HANGAR

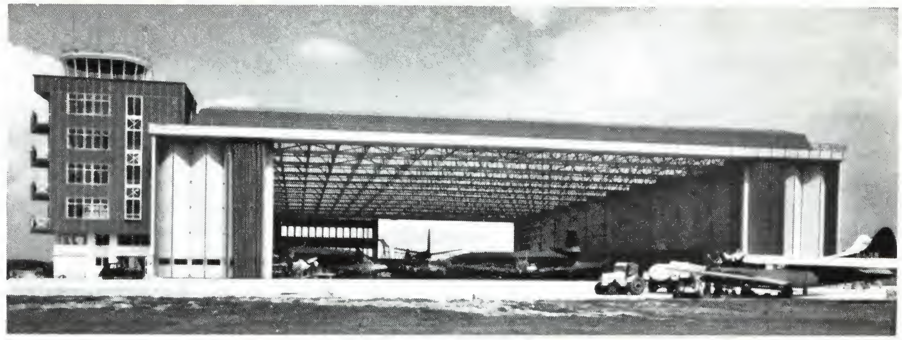
Hatfield, England 1955

James M. Monro & Son

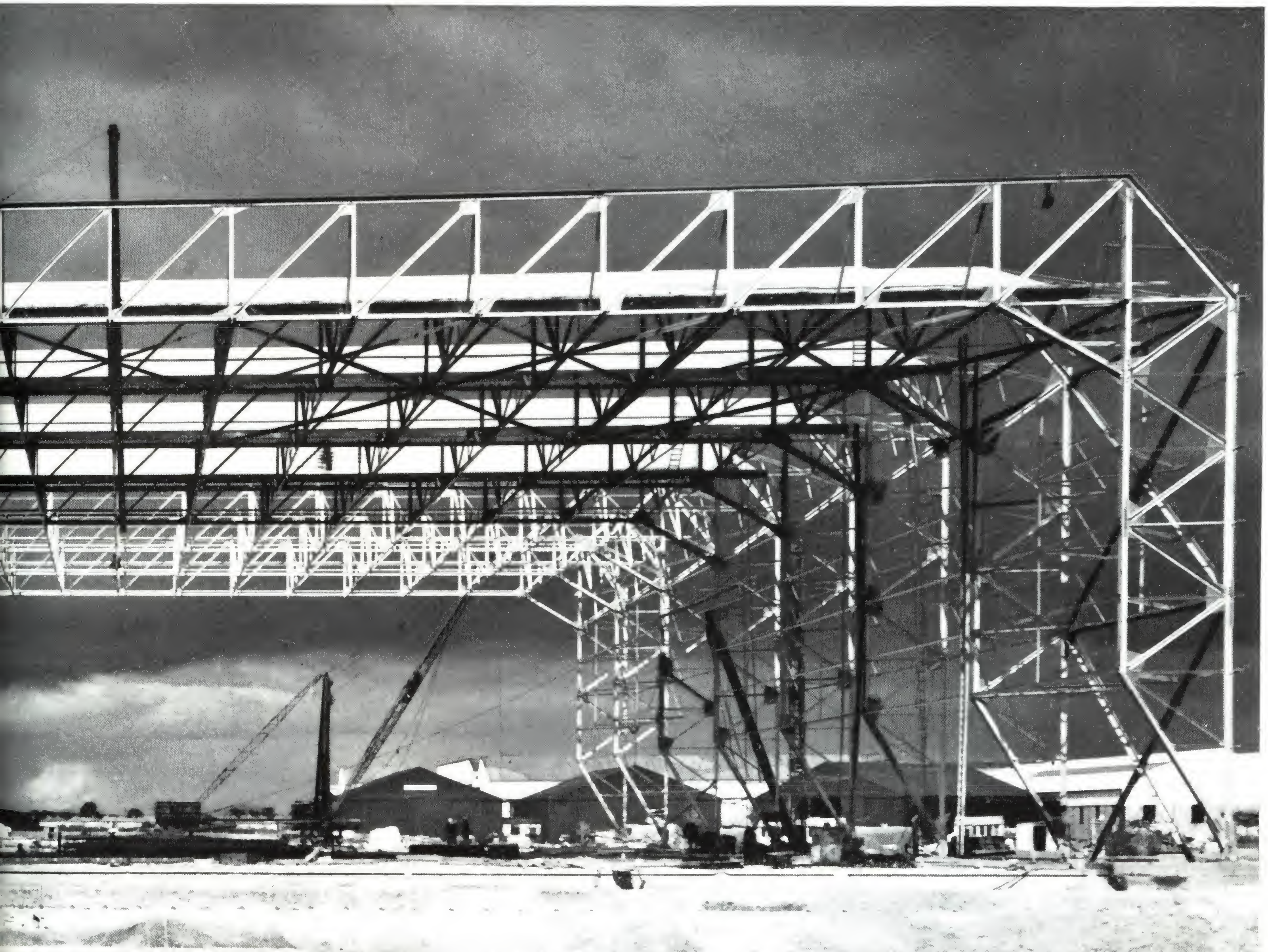
Here is a structure every bit as dramatic as the jet liners it shelters. The aluminum alloy span of 200′ is only 1/7 the weight of an equivalent steel structure. Apart from the savings in material, the light weight of the structure permitted prefabrication of unusually large sub-assemblies. Erection was handled with a minimum of labor and equipment. For instance, the main structure was erected by 18 men in 13 weeks using only two 5-ton hand operated cranes. The load on the foundations was also



greatly reduced. Exterior is covered with an insulated aluminum curtain wall. North slopes of the roof are glazed, south slopes are covered with built-up roofing or insulated aluminum decking.



*The efficient design of this aluminum span providing a clear space 200′ wide and 45′ high is emphasized in construction view shown below with the completed hangar shown in the small illustration at the right.*



# MID-WILSHIRE MEDICAL BUILDING

Los Angeles, California 1951

Victor Gruen


*Lobby walls of glass give deceptive sense of space; door and wall-panel frames are satin-finish aluminum. Note architectural harmony of smartly-styled lettering.*

The problem here was to accommodate about sixty physician tenants—plus parking—on a narrow inside lot. As is often the case in urban office building, this meant there was no choice in orientation; principal window areas face south and west, a particularly serious problem in a building that is completely air conditioned, as this one is.

To protect the big expanses of south and west windows from sun radiation before it comes in contact with the glass, the architect used exterior aluminum jalousies, adjustable by crank from the inside. He also specified aluminum mullions. His reasons for this thoroughgoing aluminum window treatment: "Weight, price and maintenance."

The consideration of weight is especially interesting in this case because the building was engineered to use structural steel, a framing method which ordinarily does not compete favorably with reinforced concrete in a building of this height on the West Coast. Unusually light steel framing was made possible only because Architect Gruen and Engineer Contini designed to reduce dead loads in every way possible. Actually, the resulting structural scheme represented a 25% saving in tonnage over conventional structural steel framing.

The narrowness of the lot and the necessity of devoting a large part of the ground floor to parking threatened to give the building's main lobby a cramped look. This was avoided by making lobby partitions—including those enclosing the drug store—of glass set in aluminum frames. The glass panels and their vertical aluminum supports are uninterrupted at the ceiling line, thus still further increasing the feeling of open and free-flowing lobby space.

*Medical profession building has simple, tasteful facade with office windows facing south and west protected by exterior aluminum jalousies with 5" curved vanes. Spandrels are cement plaster and metal lath.*

GLENBROOK HIGH SCHOOL

Glenview, Illinois 1952

Perkins & Will

This is a school open to the wide prairie, but at the same time, it encloses and subdivides a piece of the prairie to create space that has some human scale, some sense of warmth, intimacy and identity.

Because it is so thoroughly a daylight school, the architects call glass and aluminum its key materials. It is a beautifully detailed building, and aluminum is used consistently as trim, from mullions and door frames to hand rails and heater grills. Where aluminum sash is used flush at the exterior above masonry, the architects finished off the spandrel with a continuous aluminum angle. This works so well that it has become a standard detail locally.

*The angled wings, left, form intimate inner campuses. Covered passageways and trellis-like girders extend the building and cut outdoors down to human scale.*

*Through a wide window, the view at the top shows the adjoining wing, revealing the school as one planned complex of inter-related but quite independent buildings.*

*Granted good classrooms, the quality of in-between spaces, right, where students and teachers meet casually, makes the difference, say Architects Perkins & Will.*

This 43-acre hilltop site features a spectacular view of snow-capped Mt. Rainier to the southeast. In the architects' own words, the site called for "generous treatment" and they planned the hospital so that nearly all patients might share in the extra curative effects of an inspiring view and sunshine. After considering many alternate designs they settled on the straight plan with broadly sweeping bands of windows shaded by a slim overhang.

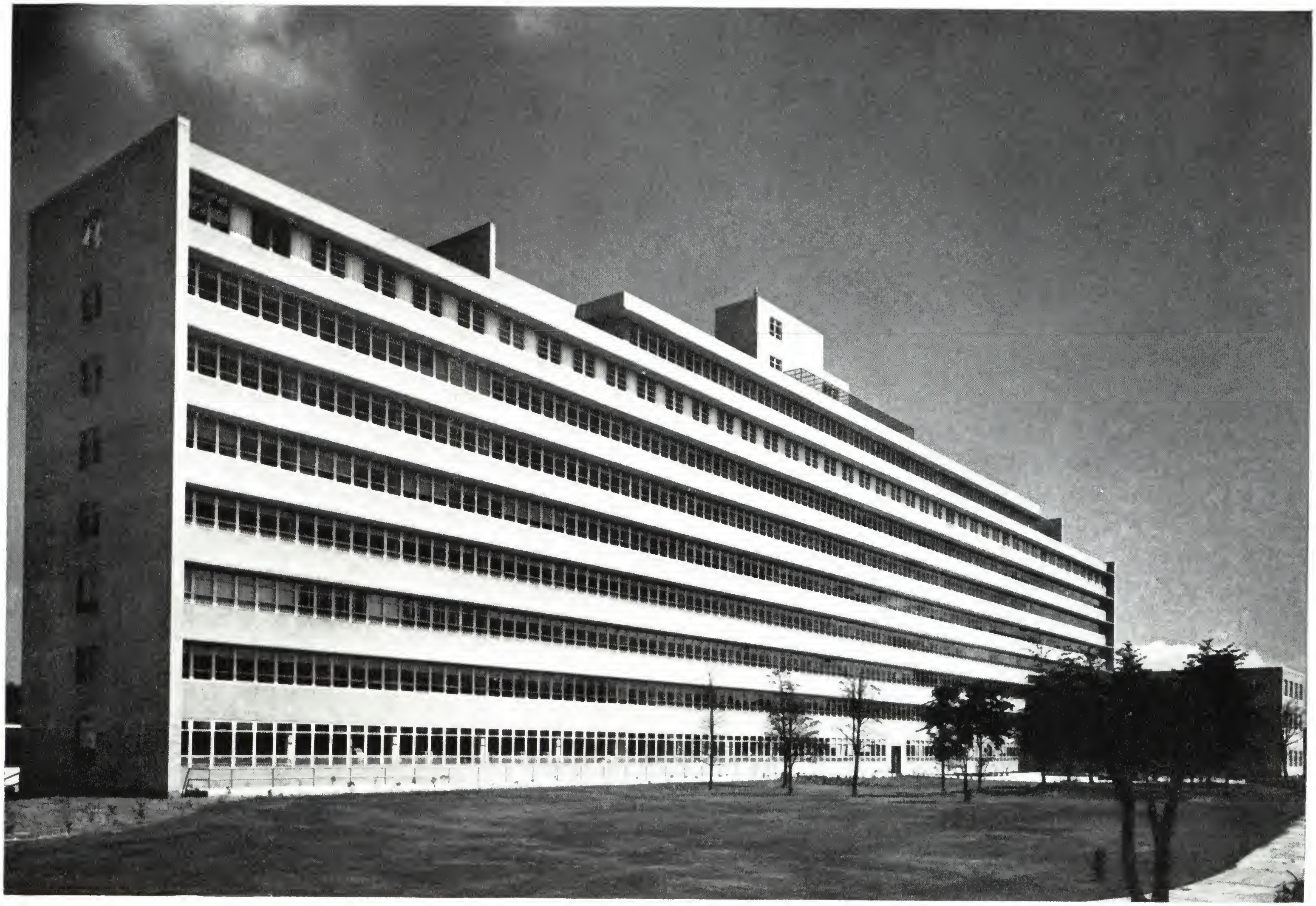
In order to keep the building's exterior practically maintenance-free, the plan called for a brick veneer exterior with aluminum fenestration, also certain aluminum spandrels and cover plate. To avoid interrupting the continuous window pattern with vertical pipe leads, all structural columns were set back from the exterior wall so that horizontal heating pipes would up-feed to convectors. There are no interior courts, no constricted shapes, hence no rooms look out on other parts of the building. This government hospital is an often-cited example of how thoughtful and prudent architectural planning, with a degree of design freedom, can contribute much to patients' care and speedy recovery.

*The architects also planned for the uneasy hospital visitor's comfort. This view from the light-filled waiting room toward entrance vestibule shows a cheerful selection of durable, maintenance-free materials, including: aluminum window and door frames, sash, cover plate facing, quarry tile sills, terrazzo floors and brick walls.*

## VETERANS' HOSPITAL

Seattle, Washington 1951

Naramore, Bain, Brady & Johanson



*Veterans' Hospital, located on hilltop, has sweeping view of Mt. Rainier. Lateral plan with continuous bands of aluminum windows was chosen so most patients could share view and sunlight. Panels alternating with windows on top floor are made up of flat aluminum sections.*

## APARTMENT HOUSE UNIT

Tenth Triennale, Milan, Italy 1955

Ippolito Malaguzzi

One way of looking at an apartment house is to consider it a vertical stack of more or less identical, individual houses. This module of space, shown at the Tenth Milan Triennale, was designed as just such an apartment house element: a simple, rectangular block, containing indoor and outdoor living areas, capable of being stacked vertically to form a handsome, quickly erected apartment building. The prefabricated structure is steel; curtain wall panels and window frames are made of aluminum.

*Designed as an exhibit in the middle of the Triennale's park, this charming little house was really developed as a single unit in a tall apartment structure. The terrace outside the enclosed living area is actually a balcony that extends right through the thickness of the apartment "slab."*

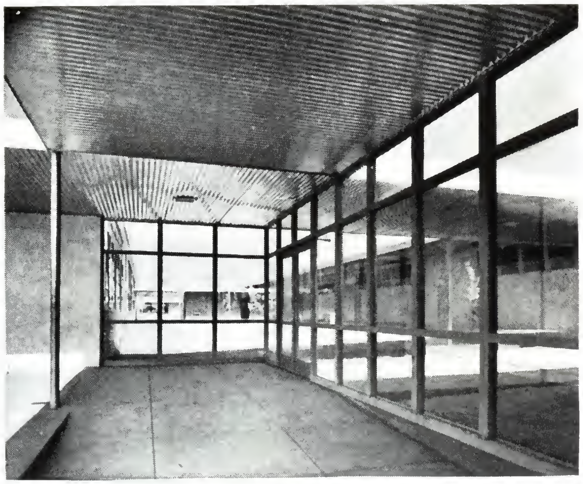
This aluminum-ribbed structure was dramatically designed for display purposes. Enclosing a methane gas industry exhibit, it has outstanding features beyond its functional attractiveness: its strut framework is demountable due to the design of its lightweight aluminum framing; it is easily transportable; it is economical, using wall panels of colorful strips of waterproof canvas lashed in place. It is so adaptable that any product or theme can be displayed harmoniously against it as an effective background.

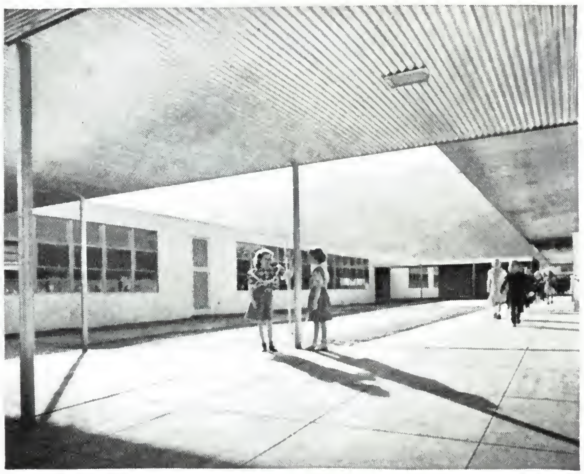
## METHANE GAS EXHIBITION BUILDING

Piacenza, Italy 1953

G. L. Giordani


*This demountable exhibition in Italy uses aluminum roof and wall structure, along with aluminum windows and brilliantly colored canvas wall panels. Lightweight aluminum structure is bolted to small pier foundations. Minimum labor is required for the erection or disassembly.*

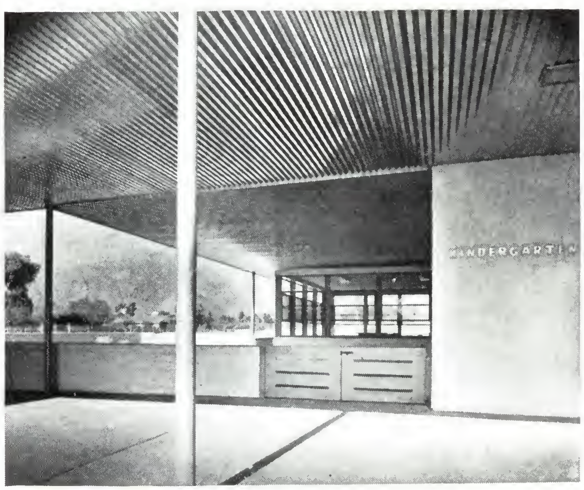




Skillfully fitted to a hot, dry climate, this economical school building provides an unusual amount of both outdoor and indoor protection against such desert discomforts as heat, glare and occasional strong winds.

Continuous covered walkways rim the interior building perimeter and connect the two classroom pavilions. These provide shaded outdoor play space, while their deep overhang keeps sun out of the high band of windows on the south and west walls of classrooms. This protection, plus careful study of building orientation, makes it possible to provide bilateral daylighting in classrooms without glare in an area where the discomfort of natural light is frequently intense.

Aluminum was chosen for the soffits of the roof overhangs as well as for roof flashing and fascia, not only for its low initial cost, but also because painting and maintenance cost could be eliminated. Since there was no corrosion problem in the dry desert air, standard mill-finish aluminum was used.



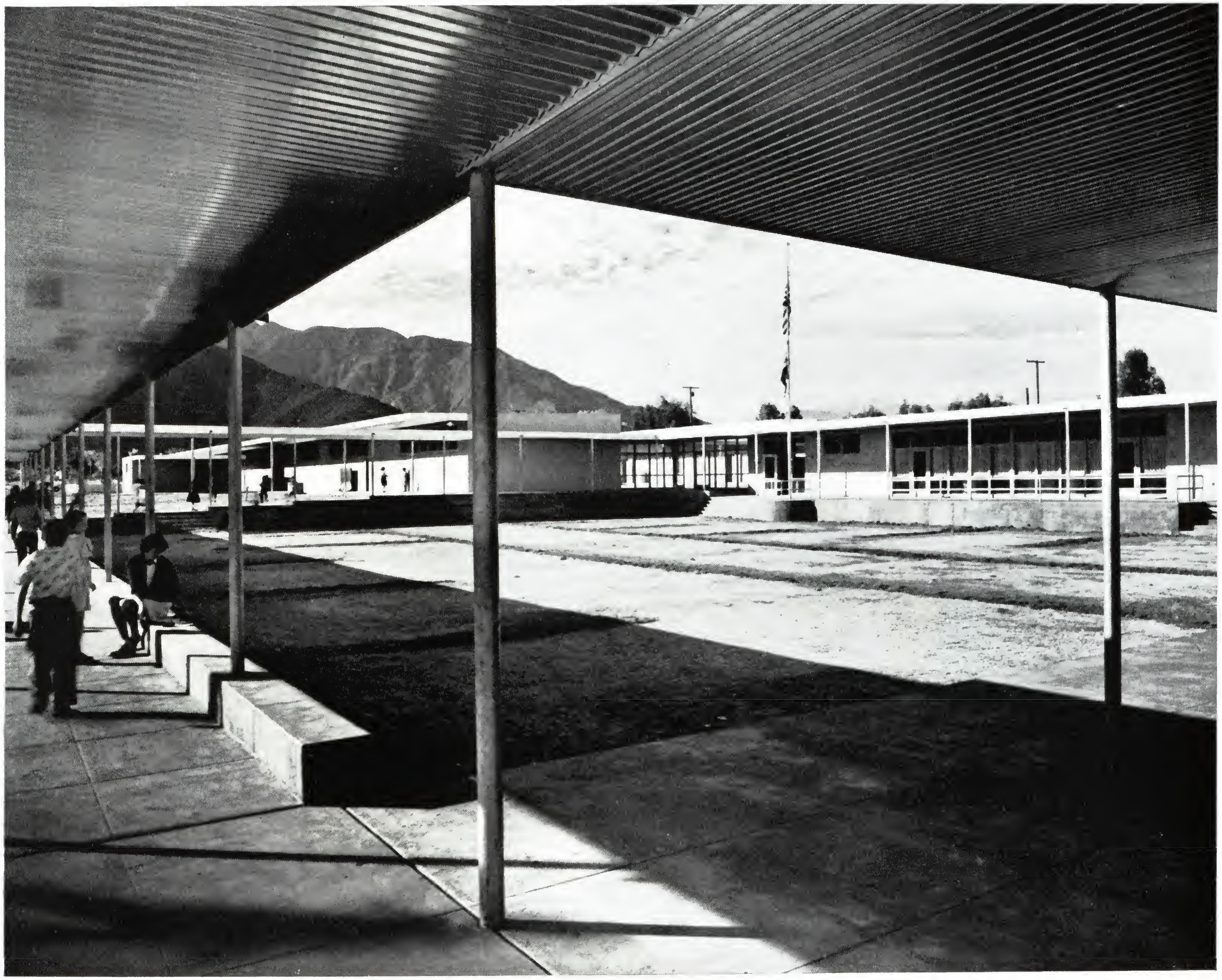
*Deep roof overhangs, shown at left, are passageways to connect the buildings and create outdoor play space sheltered from hot desert sun. Lightweight corrugated aluminum soffits help make it possible to use small diameter, economical pipe supports.*

*Buildings at right protectively surround an outdoor assembly area on three sides. Fourth is shielded against southwest wind with a wireglass screen wall.*

# KATHERINE FINCHY ELEMENTARY SCHOOL

Palm Springs, California 1950

Clark & Frey




RICH'S

# RICH'S DEPARTMENT STORE

Store for Men

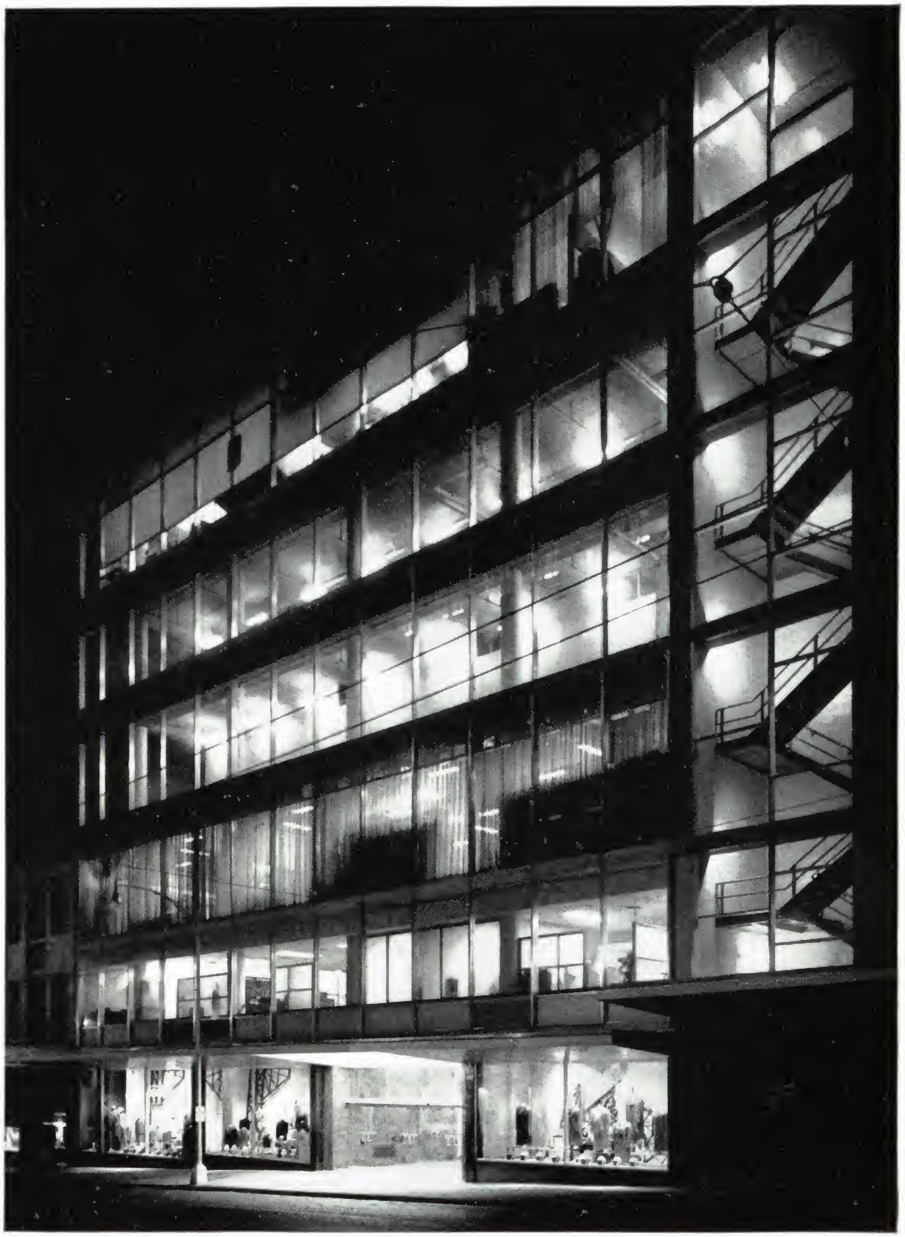
Atlanta, Georgia 1952

Stevens & Wilkinson

At the height of an architectural trend toward windowless department stores, this recent addition to Rich's famed store presents a persuasive case for the complete opposite. Natural daylight abounds in the sales areas. This helps further Rich's own theory of self selection, where the customer is encouraged by numerous special fixtures and display arrangements to pick up and examine the items.

Not only has the broad, aluminum and glass window wall proven desirable for merchandise display, but also there is a positive gain in the feeling of spaciousness on all floors. To combat any disadvantages of sun glare and merchandise fading, thin draperies have been hung on several floors. Heat-resistant glass, used in panels near the ceiling, has cut sun heat through the windows to a minimum.

The window wall is composed of large panels of ½″ polished plate glass set in extruded aluminum frames. The simple character of the facade is enhanced by a light-weight, aluminum canopy over the entrance, which also affords window shoppers protection from the hot southern sun. At night, fluorescent lights behind translucent squares of glass light the underside of the entrance canopy. This illuminated ceiling continues on past six sets of tempered glass doors into the inviting entrance.



*Crisp lines of new store's aluminum and glass facade, at left, stand out in contrast with original main store which was built in 1924. A shining illustration of the glass-fronted facade as an asset to merchandising, this is the most recent building in a whole community of downtown stores built by Rich's in the past thirty years.*

## VALLEY FEDERAL SAVINGS & LOAN OFFICE

Los Angeles, California 1954

Hutchison, Kinsey & Larsen

No building type has been more dramatically affected by contemporary architecture than the bank. Only yesterday the last stronghold of eclecticism, bank buildings over the last few years have lost their Classic—or Renaissance—or Georgian facades.

The "old vault" look has given way, on a growing number of Main Streets, to the openness of glass and the sheen of metal. Bankers have begun to rely on modern, concealed safety devices to discourage anyone who might try to take the new accessible look too seriously.

This handsome savings and loan association building also features another increasingly popular adjustment to the times—a convenient drive-in passageway along one side of the building equipped with two tellers' windows, where the depositors can do their banking without leaving their automobiles.

*Bank interior is a spacious, club-like area under a luminous plastic ceiling. Building is equipped with such handsome luxuries as a landscaped courtyard.*

*Combination of aluminum, glass and colorful enamel makes the new open look of this modern banking building. The wall, seen in these views from inside as well as out, is composed of three sections: white porcelain enamel panels at the top, fixed glass shaded by movable exterior aluminum louvers, and the lower glazed areas with alternating, fixed metal panels.*

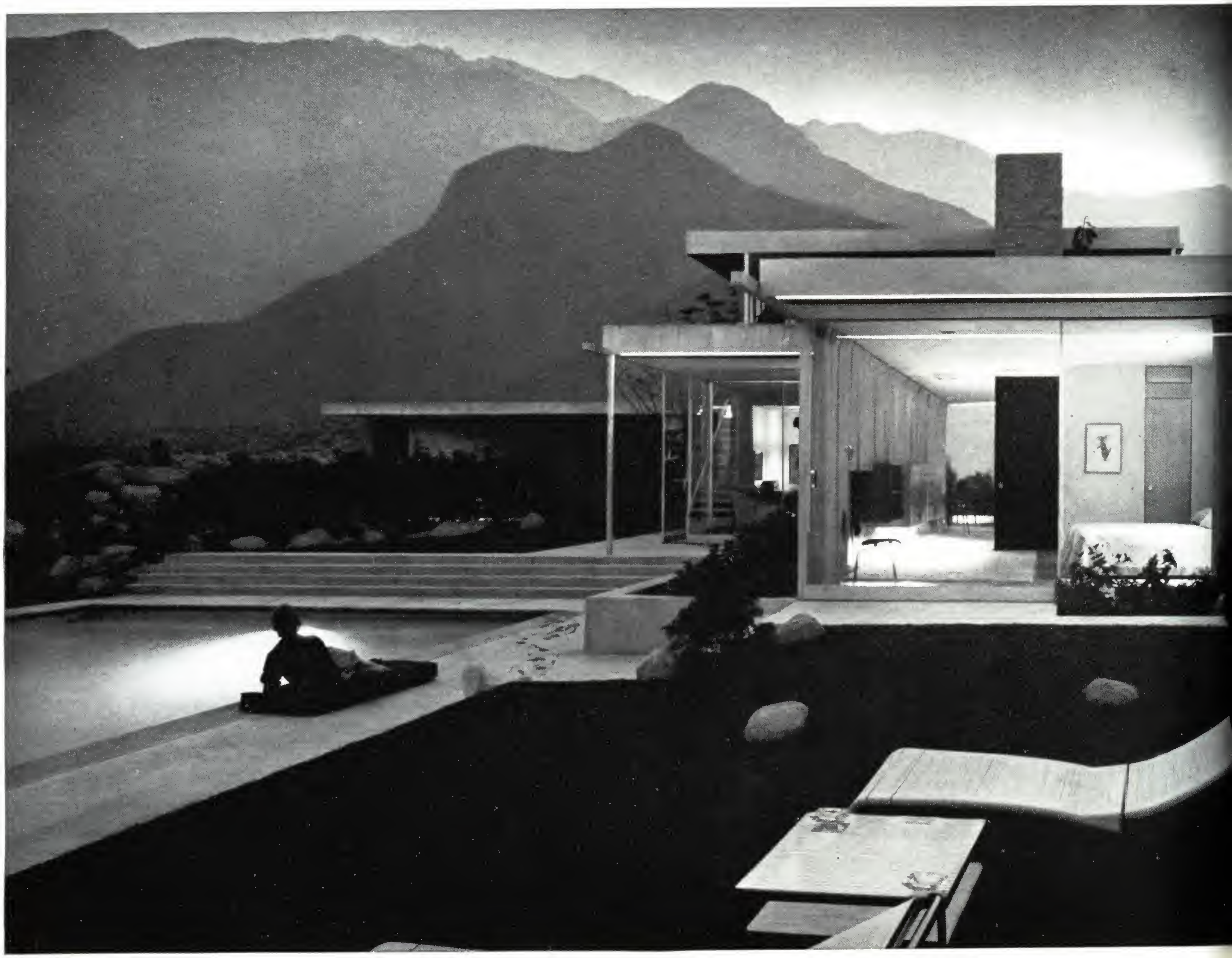
## KAUFMANN RESIDENCE

Palm Springs, California 1948

Richard J. Neutra

This luxurious dwelling, set among rocks, dunes and spiky vegetation, appears to belie the pitilessness of the California desert. But its serenity depends on the fact that every design detail is calculated to conquer the harshness of desert sun, wind and sandstorms—to conquer unobtrusively without negating the beauty of the desert.

The delicate-looking vertical aluminum striations protecting the patio are actually a sturdy stockade against the onslaughts of wind and sand that some-



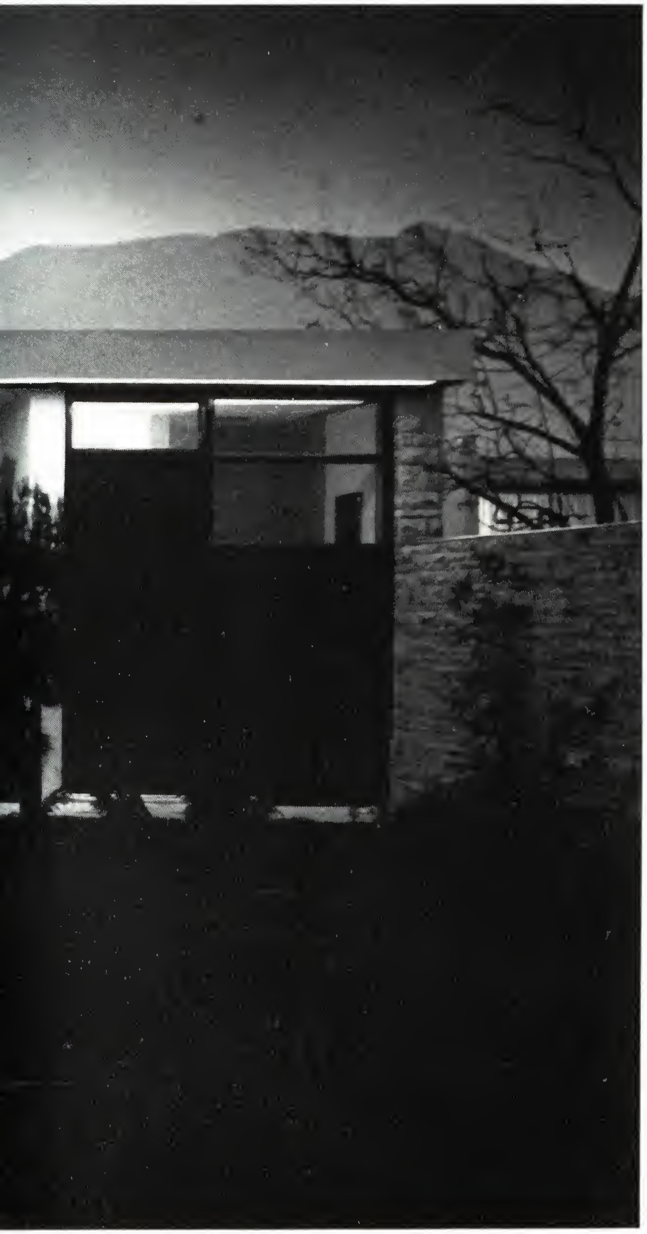
times blow in viciously from the north and west.

To turn back the sun's radiation, the trim at roof line, the window frames and columns are all aluminum or aluminum-painted so that from some angles the house looks like a delicate tracery of aluminum lines. Opaque wall panels conceal heat-reflecting aluminum foil.

Embedded within those panels, and also in the ceiling, floor and even under the outdoor pavement, are pipes for circulating heated or refrigerated water.

*This modern house makes no pretense of being a part of the desert. It is an efficiently machined pavilion for enjoying the desert without unduly intruding upon its wilderness. For example, cold cathode lights, seen under the aluminum overhangs, softly light but do not overwhelm the desert night. Pavements are white mica-glazed.*

*The social life of the house is lived outdoors. Walls of aluminum vanes, below, protecting the central patio, can be closed against the desert sun and storms or opened to admit the cooling breezes. Solid wall panels are protected with heat-reflecting aluminum foil.*



## MONT-BLANC CENTER

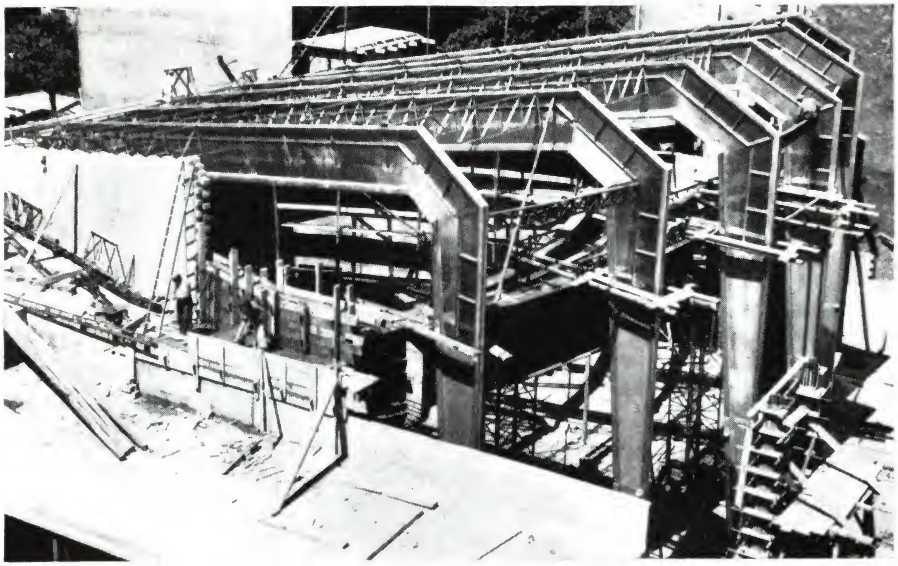
Geneva, Switzerland 1952/53

Marc J. Saugey

The construction of this remarkable building-complex on one of the most prominent sites in Geneva demonstrated at least two major technological advances of recent years: the use of prefabricated curtain walls to form the skins of buildings; and the structural use of strong aluminum alloys in the spanning of great distances with lightness and grace. Here 1,000 identical, floor-to-ceiling curtain wall units were prefabricated of glass and aluminum to sheathe the office blocks. This application was the first to use such units in Switzerland.

At top and bottom, each unit has a fixed glass panel. The center portion consists of two vertical-sliding sash elements—the top sash sliding upwards, the bottom sash downward. The two sash units operate in unison since they are connected by a simple cable mechanism. The result is a greatly improved version of the traditional double-hung window, with the added advantage that almost full openings are made possible by this unusual arrangement.

The 1,250-seat movie theater was designed for wide-screen presentations. Its structure consists of six light-weight rigid frames of a strong aluminum alloy. The frames span some 75′ and carry a system of secondary, open-web joists, also of aluminum. These joists in turn support the roof deck which is topped with aluminum sheet in order to cut down the dead load supported on the wide-span structure.



*Sliding glass units in aluminum frames form skin of office building. Structural frames of hard aluminum alloy span the theater auditorium at right. Because profiles of aluminum girders can be adjusted to changing stresses, alloy proved unexpectedly economical.*

# CENTRO SIMÓN BOLÍVAR

Caracas, Venezuela 1954

Cipriano J. Dominguez

*As a broad and daring city planning project, this concrete, tile, aluminum and glass office group is Venezuela's imposing answer to the challenge of Rockefeller Center. It is part of a master plan in which Venezuela's bright, young city planners are transforming their fast growing capital from a Spanish Colonial city into one of the world's most completely modernized cities. In addition to its twin towers and sweeping ten story blocks on each side of the street, there is a wide plaza, a vast underground concourse with shops, underground parking for 1600 cars and 600 buses, and to top it off, a mile-long, eight-lane express highway along which additional buildings will be situated.*

The whole grand scheme for Centro Simón Bolívar grew out of the need for a main traffic artery. In 1946, as the plans emerged for an express thoroughfare slashing through the center of town, the designers decided that if it was to be the show avenue of all Caracas, it should be lined with modern buildings all designed according to a master plan. While more buildings are in the designing stage, the group shown here—with a prodigious capacity of 30,000 government employees—represents a major portion of the overall building development.

From sweeping walls of light-weight louvers, to the lacy hand railings around the plaza and across the balconies of the towers, aluminum is among the major building materials. Other uses which include aluminum horizontal center hung windows, staircases, doors and store fronts with adjustable ventilators, as a matter of fact, make it one of the largest aluminum installations in South America.

At first glance, there is little about this architecture that suggests the Spanish Colonial tradition, but on closer examination a subtle selection of Old World finishes shows up within the modern framework: there is the overall masonry finish of ceramic tile which was produced in small mosaic-like squares and applied in 2′ paper-backed squares; there is the east side of the towers, seen on the preceding pages, faced with grid pattern of curved, fired clay tile sections, a material popular throughout Latin America.

*Balconied towers with aluminum railings overlook broad elevated plaza which has become the busy public gathering place where Caraquenas throng to see exhibitions, dance spectacles and religious celebrations.*

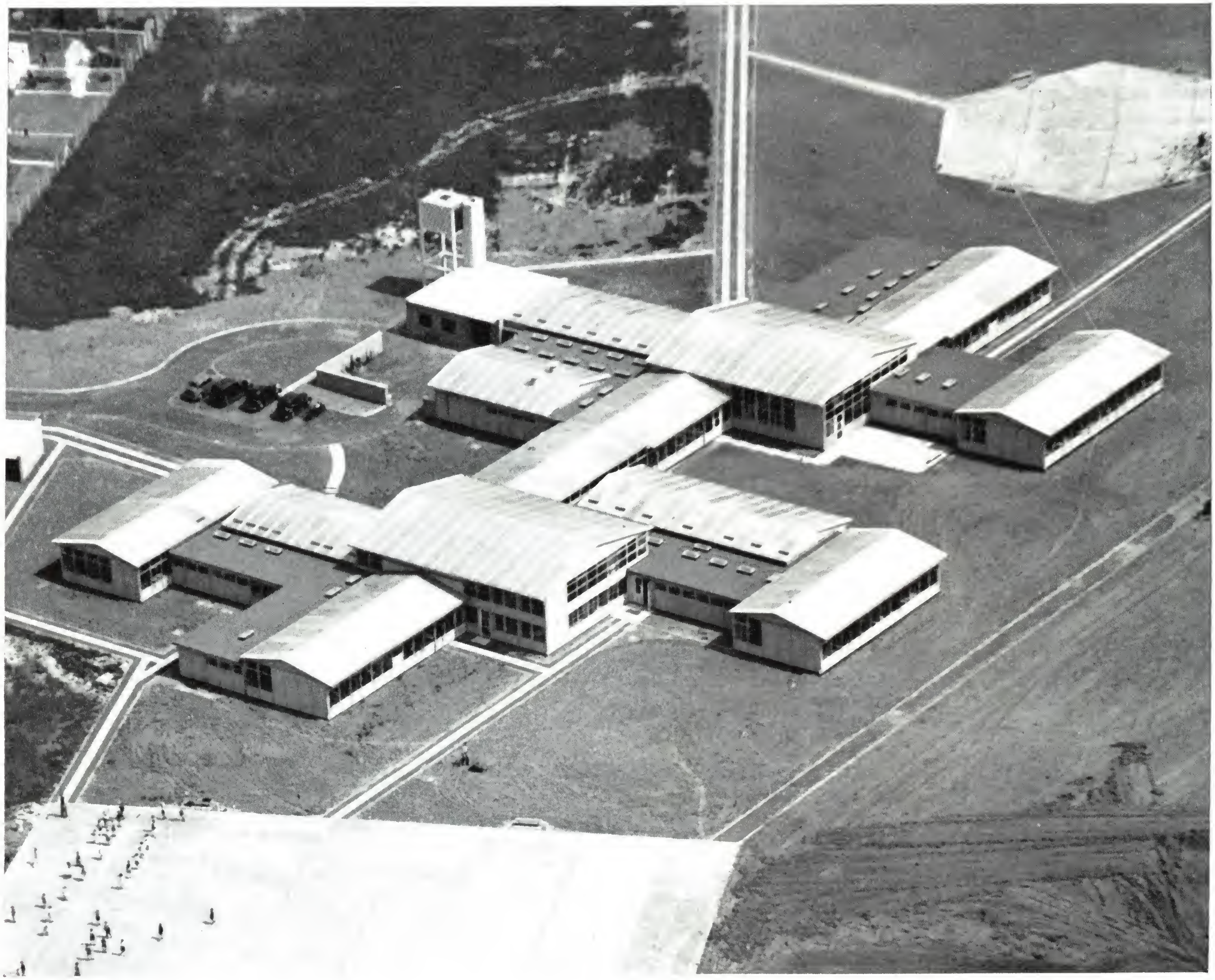
*Nearly identical, ten-story office blocks on each side of the street have horizontal aluminum louvers for sun protection. Windows are aluminum, horizontal, center hung. Buildings are lined with shops at the street level, the only occupants which are non-governmental.*

*Aluminum railing curves gracefully around curved edge of open air plaza. This view of tower shows dark and light tones of mosaic-like masonry finish. Underground commercial area with various shops and services runs beneath both ten-story buildings and the towers.*

# LIMBRICK WOOD COUNTY PRIMARY SCHOOL

Coventry, England 1952

Bristol Aeroplane Co., Ltd.

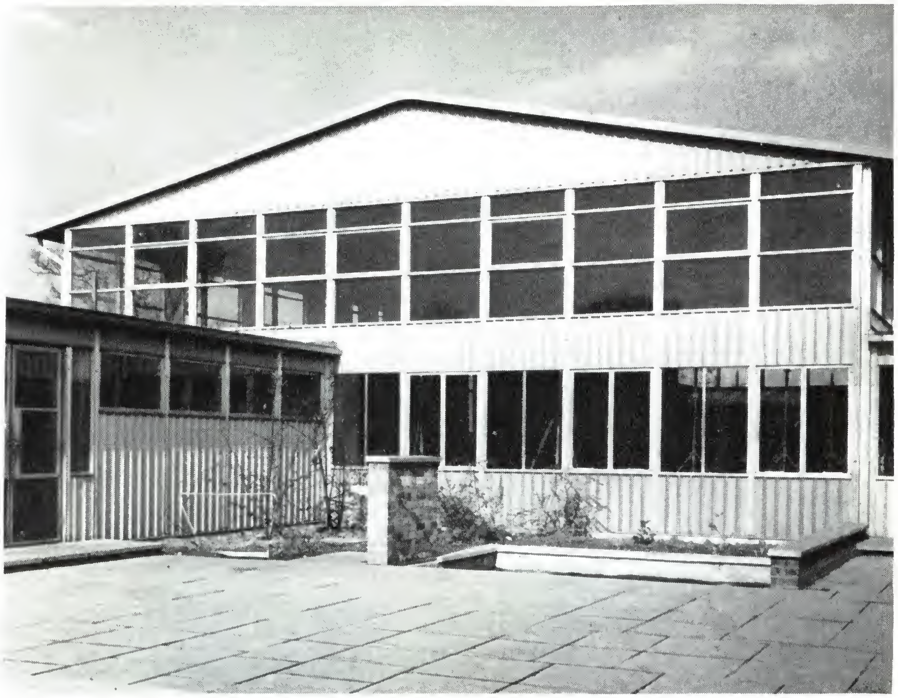


Prefabricated aluminum "Bristol Buildings" are among today's most celebrated examples of architectural standardization. Admired more generally for their technical resourcefulness and practical economics than for their appearance, they are going up all over the world as everything from hospitals and post offices to telephone exchanges and airline terminals. This particular one in Coventry, England, is notable as the first of many schools to be built by this now-famous system.

One of the principal reasons for the success of the system is its great flexibility. Wall "panels," in five heights, are actually two extruded aluminum mullions, which can be filled in with all manner of combinations of glazed and solid units on a 4′ module.

The buildings go up in about a third the time required for orthodox construction and demand little skilled labor at the site. The light weight also cuts foundation costs to the minimum. Almost no external maintenance is required, but in schools like this, panels are often brightly painted for decoration.

*This air view of the school buildings shows the aluminum roof units. In spans up to 40′-3″, they are often supplemented by lean-to roofing for corridors or valleys. The Bristol system also includes louvered flat roofing for toplighting. Wall panels are bolted to aluminum perimeter channel which is bolted to slab.*



*This school is built of prefabricated aluminum parts devised by an aircraft company. The high building, above, is an assembly hall. Interior view, below, shows hung fiberboard ceiling supported by aluminum T sections which also serve as cover strips. All structure is extruded aluminum; exterior cladding is rolled aluminum.*

# SHULMAN RESIDENCE

Los Angeles, California 1951

Raphael Soriano

One of the most logical new ways of building a house is to construct a flat slab roof on a few light columns spaced far apart, and then subdivide the space under this roof with partitions of glass, metal or wood. California Architect Soriano has done much to perfect this system, and this house is an excellent demonstration of his approach.

Designed for a free-lance photographer, the building consists of two elements studio and living quarters, linked by a covered passage. Flat-roof slab rests on pipe columns set in 8′ x 24′ bays, and these $3\frac{1}{2}''$ diameter columns are its sole support.

Under this, Architect Soriano then placed a series of glass and metal partitions, and a number of prefabricated storage walls. None of these is structural. They serve only as space-dividers. All glass is set into aluminum frames. Screened patios surround the house so that almost every inside room is supplemented by a corresponding outdoor "room" that can be used during much of the year. This screening is also set in lightweight aluminum frames. Parts of the exterior, seen at left, are faced with aluminum sheet in elegant, narrow corrugations.

*Corrugated aluminum sheet was used to face entrance side of the house and garage doors, opposite page. Its $\frac{3}{4}''$ corrugations are elegant and fine in texture.*

*Each bedroom, above right, has a screened patio outside its sliding glass walls. Screening and sliding glass are framed in aluminum sections. Right, large patio separates living quarters from photographer's studio.*

# WHITE OAKS ELEMENTARY SCHOOL

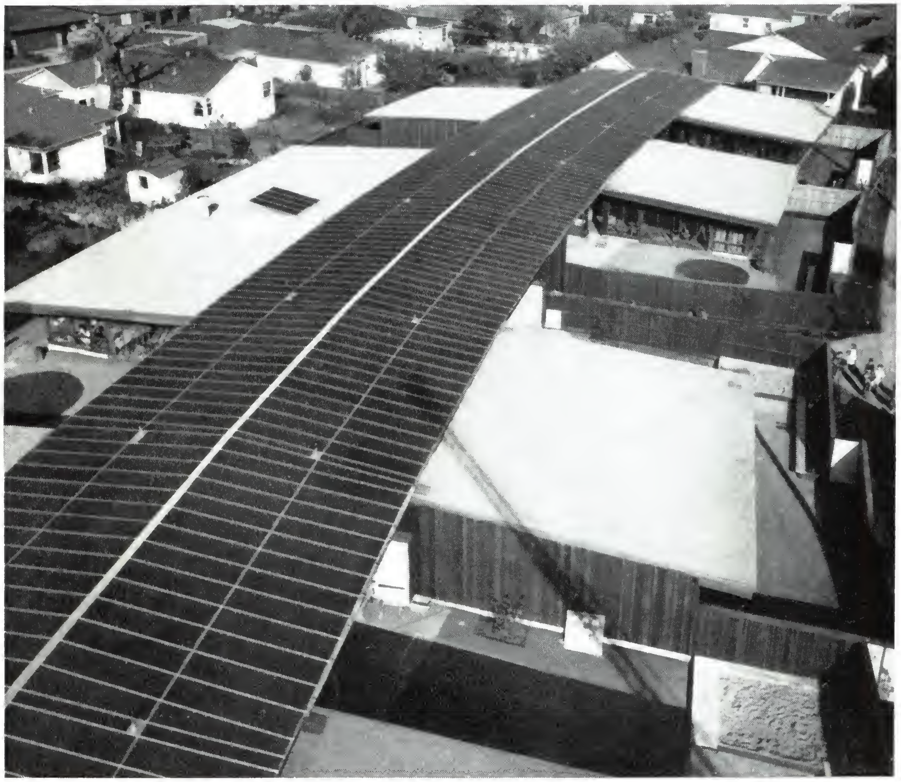
San Carlos, California 1953

John Carl Warnecke

This eight-room kindergarten-primary annex was the top school award winner of 1954. Its scheme of a little house and yard for each classroom creates a non-institutional, domestic character suitable to its residential neighborhood and reassuring to beginning students. The building group makes better than 90% educational use of the site.

The scheme hinges on the architect's imaginative use of a central aluminum-frame skylight. This glass-and-aluminum spine, 235′ x 35′, gives top-lighting to the interior third of each classroom and to toilets and storage rooms. Altogether, it provides 594 sq. ft. of covered outdoor play space for each class. It creates a well-lighted corridor and neatly integrates the various units of the entire building.

Although the skylight curves to conform with the fan shape of the site, the architect uses standard 18′ extruded aluminum bars throughout, and obtains his necessary curve by tapering the 2′ x 9′ panes of glass where the skylight intersects the classroom partition lines. The glass irregularity is thus scarcely noticeable since the orderly regularity of the aluminum framing members is so dominant. The cost of the skylight installed, complete with heat-resistant blue-green wireglass, was a reasonable $2.10 per sq. ft.—an outstanding example of the economy achieved by resourcefulness and ingenious, careful design in the face of a tricky problem.



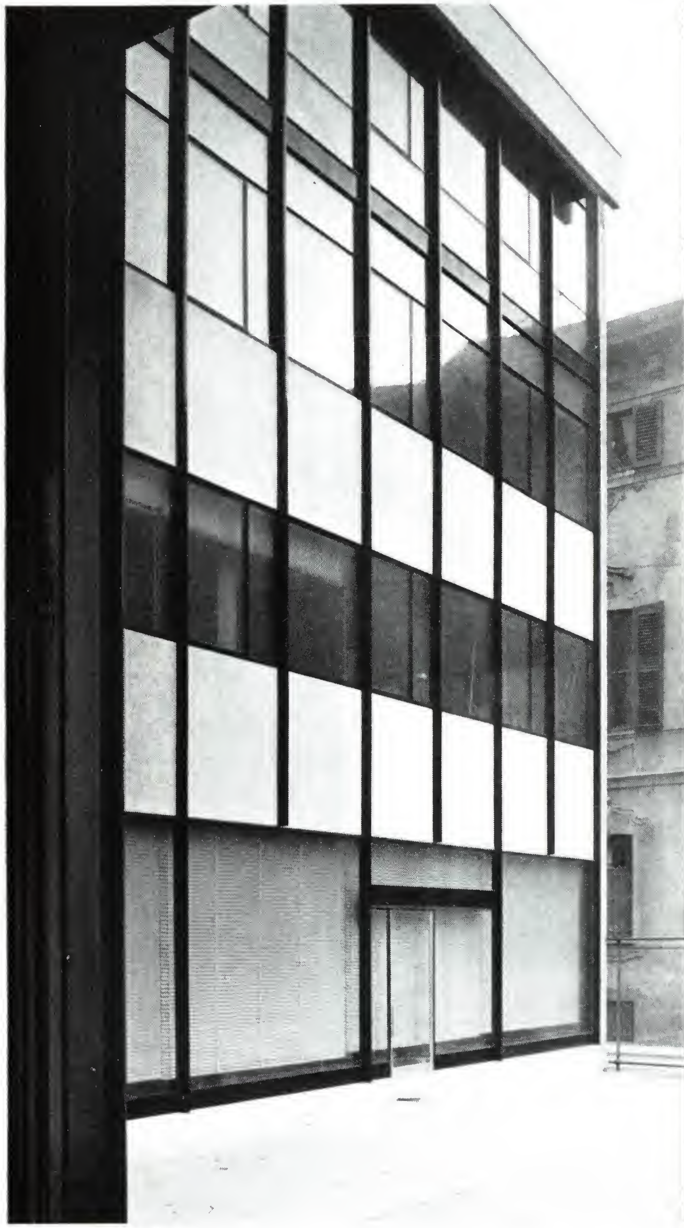
*Gradually curving aluminum-and-glass roof ties together eight classrooms, lights their interior areas and shelters part of their outdoor play space. School fits harmoniously into suburban area of small homes, is true extension of home environment.*

*Cheerful corridor, opposite page, airily roofed with blue-green glass and aluminum bars, is used for games and as children's friendly and sociable "Main Street."*

# OLIVETTI OFFICE BUILDING

Milan, Italy 1954

G. A. Bernasconi, A. Fiocchi and Prof. M. Nizzoli



When Olivetti's new Sales Headquarters opened in Milan in the spring of 1955, designers and critics expected something of the highest architectural quality, and they were not disappointed.

Located not far from the Duomo Square, the new Olivetti building is roughly L-shaped in plan. Its ground floor serves as an exhibition hall and is completely glass-enclosed, so that pedestrians can see the garden in back of the building. The upper floors contain business offices.

Because the main office block faces southwest, it was necessary to provide easily adjustable sun-protection on the outer face of the building. This was done with a "curtain" of vertical aluminum louvers, whose exact angle can be adjusted from the inside by a crank mechanism.

Aluminum—a material familiar to Olivetti, for the company uses it extensively for business machine casings—was used in many other details as well: in exterior and interior finishes, in doors, windows, and special hardware, and in movable, lightweight office partitions. The pictures on the next pages show close-ups of some of these handsome details.

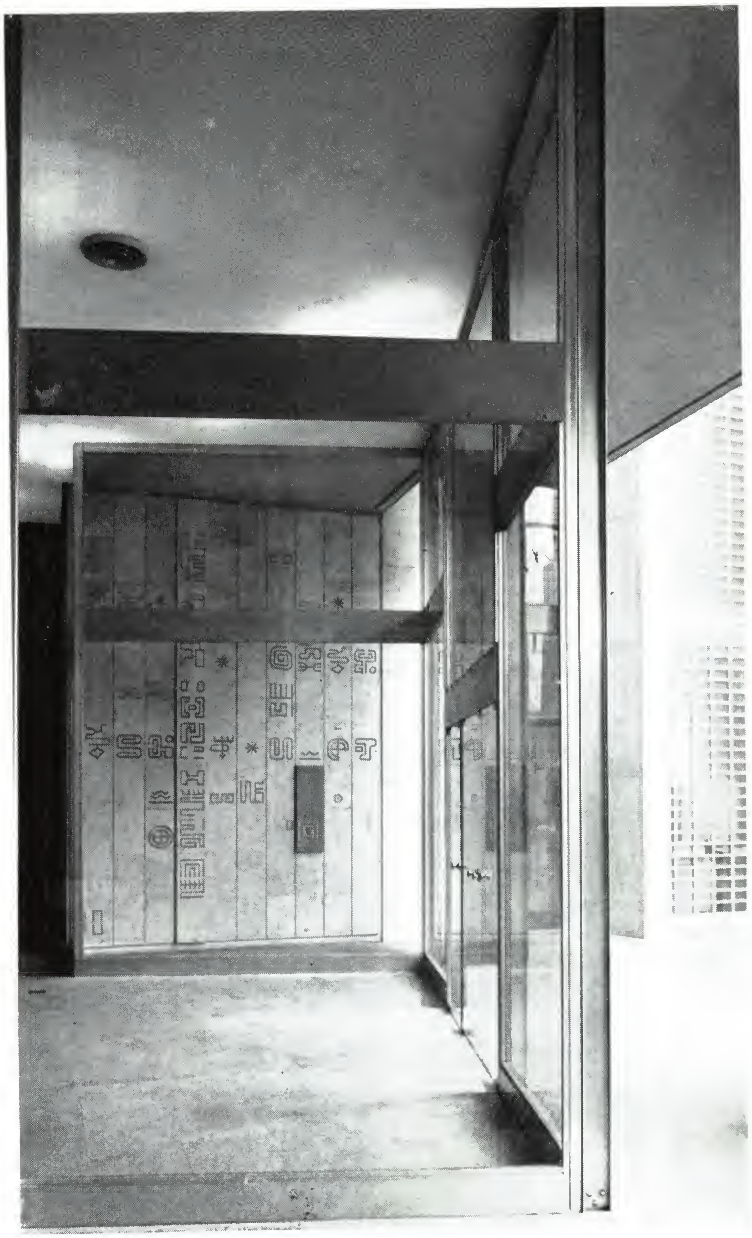
*One of the most beautiful façades in contemporary architecture, at left, materials in 4-story office are anodized aluminum, glass and polished "botticino" marble.*

*Entrance level, at right, is glass-enclosed exhibition hall, with a covered drive in between, leading toward parking lot and garden in rear of the main office mass.*

# OLIVETTI OFFICE BUILDING

*Relief in Saltrio stone decorates wall near main entrance, was carved by Giovanni Pintori. All door and window frames are of anodized aluminum. Floors in this part of the building are paved with granite. Entire ground floor of building is glass enclosed so that the approaching visitor has an unobstructed view of product exhibition and garden.*

*Aluminum sun-control louvers on 8-story building, controlled by an inside crank mechanism, keep heat away from windows, permit it to dissipate before it can radiate into interior spaces. Windows of smaller wing project out for cleaning. Building stands out in startling contrast with buildings of older periods which surround it on Duomo Square.*



*Below: close-up of movable, light-weight aluminum and glass partitions used on all office floors. These prefabricated partitions are self-supporting, require no attachments to floors or ceilings; they can be assembled and disassembled within one hour. Bottom left: main entrance of the 8-story office building, showing mural by Mattia Moreni at left. Bottom right: special, black anodized aluminum door handle design by Professor Nizzoli for this building. Nizzoli is world-famous for his design of Olivetti business machines, many of which use cast aluminum parts.*


לא תרצח
לא תנאף
לא תגנב
לא תענה
לא תחמד
כבד את
EXIT

# MT. ZION TEMPLE

St. Paul, Minnesota 1954

Eric Mendelsohn

Bergstedt & Hirsch, *Architects for Completion*

This low, serene building was built from partly finished drawings left by one of the great pioneers of modern architecture. Eric Mendelsohn, who died in 1953, had no modern master in creating the vast and quiet spaces and the gleaming symbols that have for many centuries assisted man in his search for God.

From the very beginning of his work in Germany at the opening of the twentieth century, Mendelsohn sought to create in machine-made materials the modulated continuity of form he saw in nature. Mendelsohn's great gift for realizing the plastic qualities of the new materials is apparent in both the exterior and the interior of this synagogue.

The pulpit uses metals richly and in unquestionable good taste. The ark doors at the top of 12 steps, symbolizing the tribes of Israel, are wrought of aluminum and brass in combination. This combination of warm and cool hued metals is also used on the speaker grille and candelabra. The suspended light fixture is aluminum, as well as all fenestration, except windows in chapel and temple.

*This Mt. Zion Temple in St. Paul, Minnesota, is one of Mendelsohn's last designs. His detailing of delicate ornamentation gracefully juxtaposed against severe planes and unbroken curves is a recognized challenge to expert craftsmen and builders.*

*The shrine of the ark shows a master's hand in often-neglected decorative use of aluminum. Its intricate doors, seen at top of steps, are aluminum and satin-finished brass. Its background is a screen of light birch ribs against which is set a brass and aluminum crown.*

# LAMBERT-ST. LOUIS MUNICIPAL AIRPORT

Terminal-Administration Building

St. Louis, Missouri 1954

Hellmuth, Yamasaki & Leinweber

Flight is hard to live up to, down on the ground and most air terminals, even those with a fine view of the big ships alighting and rising, are a sorry anti-climax. But this new St. Louis airport is a part of the air age. Seen from the sky, or entered from the ramps, it manages to be as boldly improbable as the airplane itself, with much the same feeling of lightness, taut strength and big dealings in space.

Its three concrete groin vaults, each rising 32′ above the floor, give an area 360′ long and 120′ wide, entirely unobstructed by columns or partitions. Three more vaults planned for the future will double the length of the vast room.

Glass, aluminum and marble are being depended on to reduce maintenance and keep the terminal as glossy as planes. The architects have enumerated the items for which they use aluminum; swing, sliding and rolling curtain doors, door frames and thresholds; skylight bars; flashing; coping; light fixtures; grid framing for plastic ceiling; screening; mullions and glazing grid, sash and sills; sign housings; downspout covers; railings; divider strips; laminated structural panels; hardware; lightning conductors; louvers; channels, angles and bars.

*Light pours into the terminal through the glazed ends and sides. Glass also carries up over the top, to where the adjoining concrete vaults touch each other.*

*The view from entrance ramp, right, shows enormous glass side section secured in a web of aluminum mullions and muntins. Note how well the curves of the muntins complete and complement the curve of the vault.*

*In form, this airport terminal, of adjoining concrete groin vaults, suggests airplane hangars. Its aluminum and marble detailing is highly refined and sophisticated. Middle floor level has baggage handling, passenger access to planes. Lowest level has services, mail and freight.*

# RICHMOND CIVIC CENTER

Richmond, California 1949

Milton T. Pflueger


An outstanding example of the kind of functional, consolidated civic building groups that have recently been built in many moderate-sized cities, this Civic Center provides an auditorium, a city hall, a hall of justice, and a library. All this adds up to a building group of substantial size, but size has not been permitted to dominate the design. The new, accessible look of contemporary civic architecture is here, too. Accessibility is a matter of both building plan and building materials. An important contribution of the twentieth century revolution in architectural design, it is particularly important in the public buildings of a democracy. Open design like this does not overawe the citizen with the power of the state; it suggests, instead—these are your buildings, they welcome your use.

Accessibility begins here with the broad, easy steps up to a long colonnaded and sheltered approach to the main entry. A glass-walled lobby gives openness to the building. Inside the lobby, an easy open stairway invites the visitor further upstairs.

*This Civic Center's inviting exterior, above right, is matched with the non-governmental looking interior shown below. Aluminum railed stair to second floor is enclosed by glass and flanked by planting boxes.*

*Stock aluminum sash, left, is the frame for open glass front of the lobby. Brick, glass and aluminum are widely used in the building industry as materials that will remain fresh indefinitely, yet require little upkeep.*

# ARVIDA BRIDGE

Arvida, Quebec, Canada 1950

Dominion Bridge Company, Ltd.

This is an all-aluminum highway bridge—the first of its kind in the world—and a milestone in the use of structural aluminum. It is extremely light: the total dead load is about $\frac{1}{3}$ the equivalent in steel. While the design did not exploit this lightness for a new look of litheness and grace, the development of unconventional, high-speed fabrication and erection methods represents a genuine achievement.

Fabrication by typical methods employed in steel box girder structures was out of the question because the aluminum alloy was heat treated. It was impossible to subject it to extreme heat without loss of strength. This ruled out flame cutting, hot riveting and welding. Instead, all cutting was done by band saw, a practical timesaver, as most parts were light enough to be moved around by hand. Fastening was done with large cold-driven rivets, using a newly developed technique.

Lightness also permitted an easy system of erection—particularly welcome in this rocky, inaccessible site. Since heaviest rib sections weighed only $6\frac{1}{2}$ tons, the bridge was assembled from $1\frac{3}{8}''$ wire ropes strung between derrick booms on each shore. Whole deck panels were so light that they were assembled on shore and swung out into position.

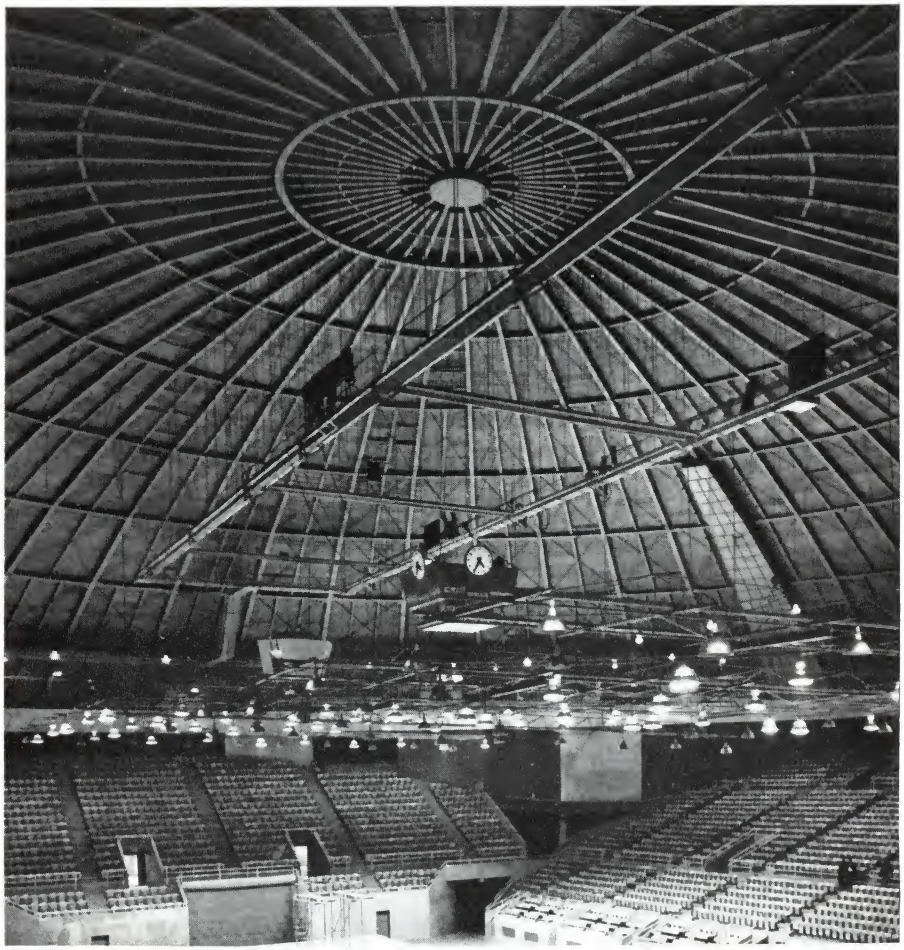
*Aluminum structure of bridge was designed alternately in steel and aluminum. Final choice, logical since bridge is located in heart of Canada's aluminum industry, was experiment in freeing architects and engineers of costly struggle in combatting weight with weight. Unprecedented structural use necessitated extensive research.*

*World's first all-aluminum bridge, weighing only 200 tons, was built over rocky, irregular terrain without need for complicated system of falsework. Instead, assembly was done from suspended wire ropes. Total length of bridge is 504'; arched span is 290'. Weather-resisting aluminum was cleaned, but left unpainted.*

# CHARLOTTE CIVIC CENTER COLISEUM

Charlotte, North Carolina 1955

A. G. Odell, Jr. & Associates



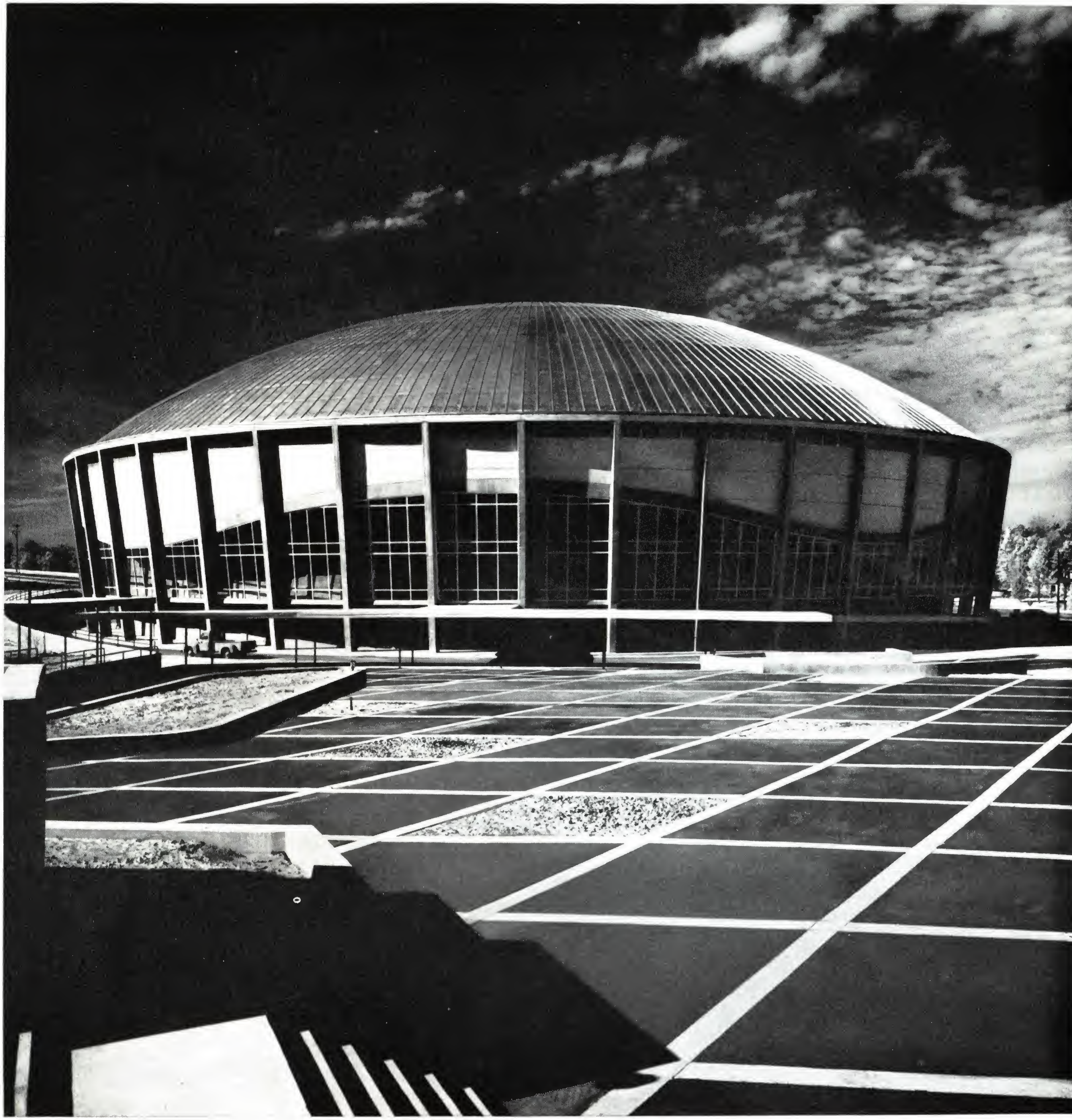
*This view of the ceiling shows the arched-steel web that supports a dome nearly three times the size of St. Peter's in Rome. The 45′ diameter compression ring at center was erected on a scaffold; the 1000′ circumference tension ring was placed on top of the concrete columns. Both rings were fabricated of welded steel. Arched ribs, 176′ long, are reinforced with 1¼″ tie rods. Structural design was based on a technique invented in 1863 for smaller domes by the German steel expert, J. W. Schwedler.*

This aluminum-sheathed roof, two full acres in area, is the world's largest dome. Covering a massive 10,000-seat sports and entertainment arena, it is part of the new $5 million civic center at Charlotte, North Carolina.

The framing system used for the roof is an outstanding example of savings both in weight and in cost. In fact, it has been acclaimed as a most economical roof framing system. It consists of an arched-steel web, spanning a center compression ring and a circumferential tension ring, all of which is supported on just 48 sloping concrete columns, 53′ in height. Precast-concrete panels are used for the exterior wall above the spandrel beam, which supports the concrete seating arrangement. The remainder of the wall area is glazed.

On the webbed-steel framework, precast-wood-fiber planks were laid, topped by 1″ of poured concrete and an overlay of tarred felt. Since no structural member exceeds 18″ in profile, keeping the deadload at a minimum on this slim structure was essential. The 3650-piece aluminum skin, .032″ thick, weighs less than ½ pound per square foot. Individual pieces were joined by flatlock seams with ample allowance for expansion and contraction. The architect reports that this lightweight covering was installed with a minimum of manhours and proved the most practical solution for keeping so steeply pitched a roof weather-tight and maintenance free.

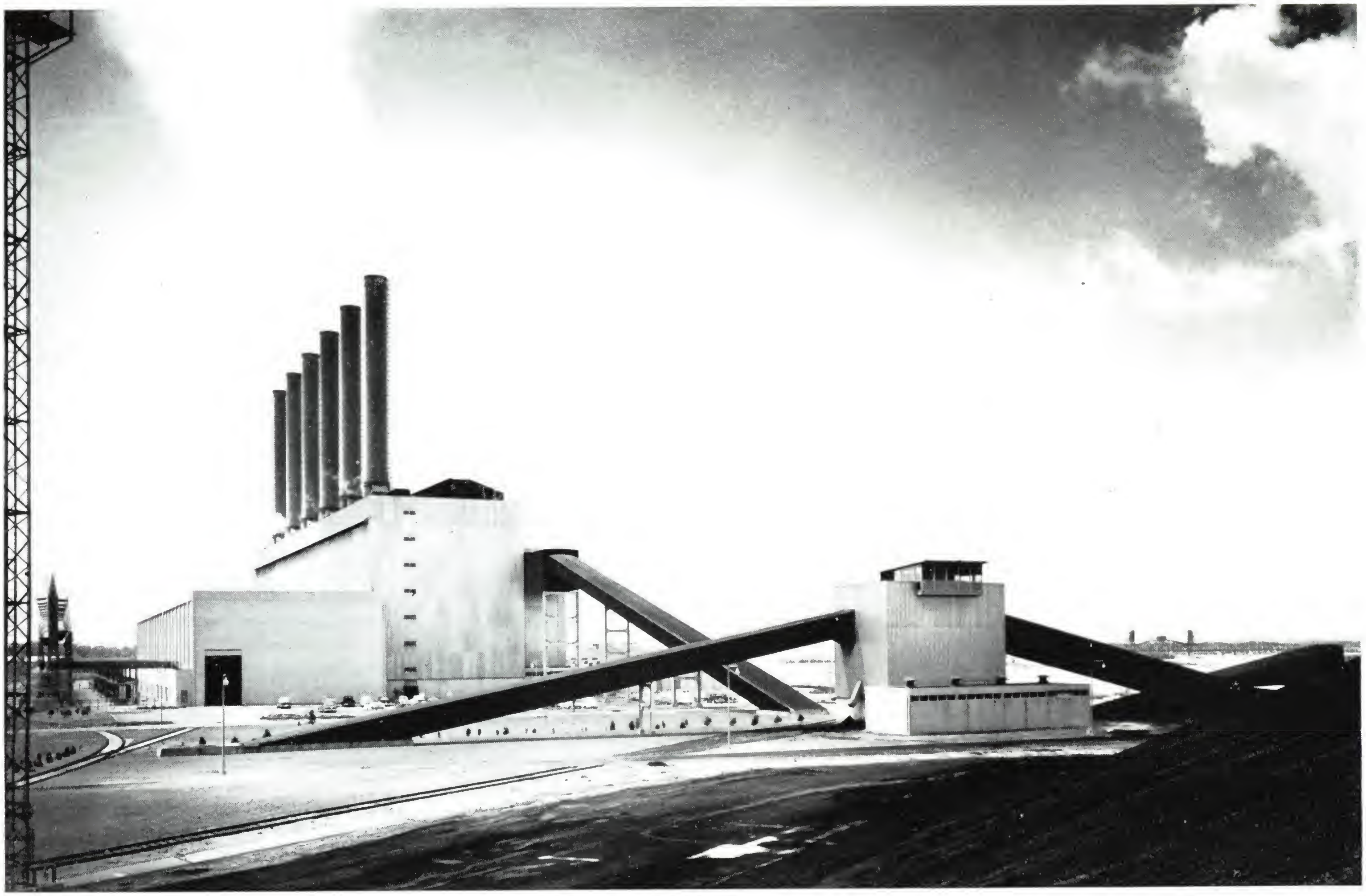
*Precisely sheathed aluminum roof is supported by 48 sloping concrete columns; angle of outside wall helps keep rain off of huge window wall. Dome has a 334′ span, is engineered to withstand a 125 mph windstorm. Total weight of roof structure was held to 970 tons.*



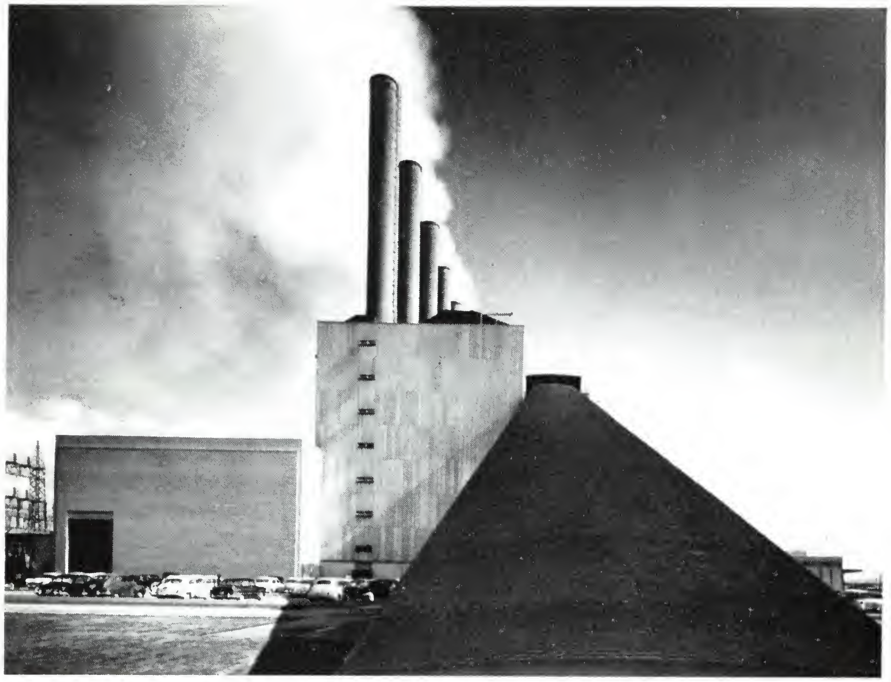
## TVA STEAM-ELECTRIC PLANT

Johnsonville, Tennessee 1950

The Tennessee Valley Authority



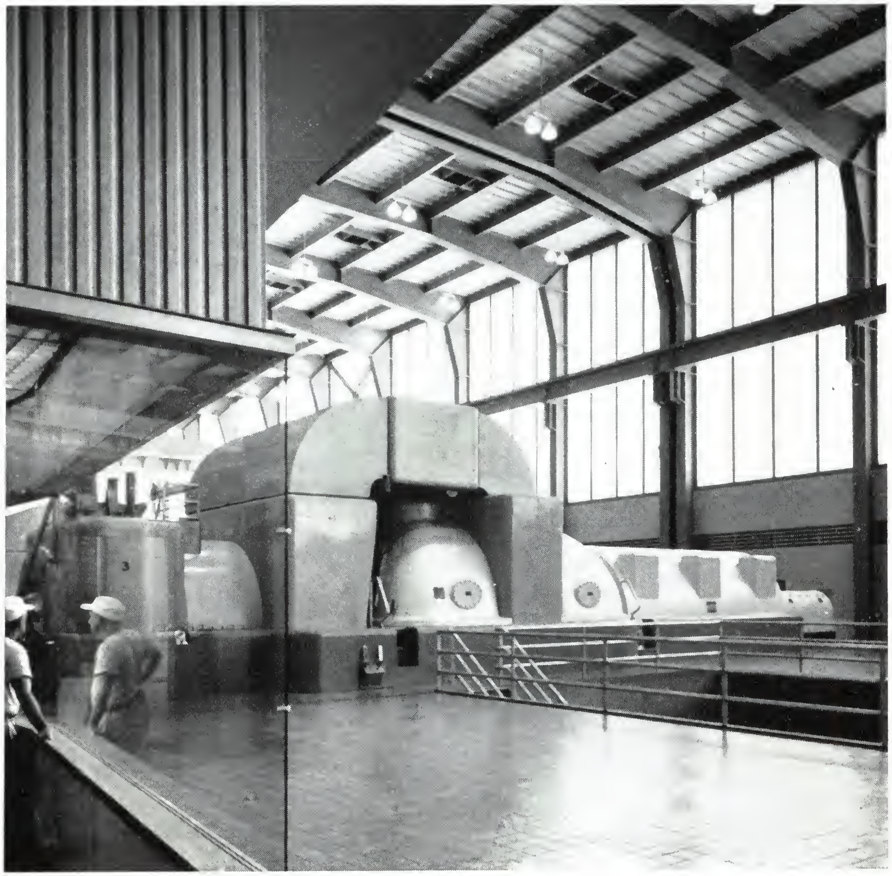
*A handsome example of government-sponsored architecture, this giant aluminum and brick-faced steam plant was built to supplement varying supply of TVA hydroelectric power. Conveyors criss-crossing in above view furnish six-boiler unit with coal at tremendous rate of 300 tons per hour. Upper section of buildings uses rigid aluminum-faced panels with glass-fiber insulating core and interior surface of zinc-coated sheet steel.*



To provide supplementary power to compensate for the changing flow of the rivers, TVA has erected a series of huge steam-electric plants. One of the most distinguished architectural examples is this aluminum-sheathed plant on Kentucky Lake in Tennessee. When operating at peak capacity of 750,000 kw output, its six units consume a gigantic 300 tons of coal per hour. Hence, it was located for easy access to the lake, railroad and highway.

Bringing these vast building elements into human scale was an architectural challenge. Materials were selected which would symbolize the machine-like character of a modern industrial plant. They were limited in number largely to bases of gray brick and prefabricated aluminum-faced panels above. Interior surface of aluminum-faced panels consists of 16 ga. (Manufacturers' Standard Gauge) zinc-coated flat steel sheets. The $1\frac{1}{2}''$ space between panel faces contains glass-fiber insulation. Panels were welded to adjustable steel girts attached to structural steel.

In the architect's opinion, the advantages of the aluminum-faced wall panel were many: it went up quickly; it was easily replaced if damaged during installation of heavy equipment; maintenance is simple and there are no ill-effects from weathering.



*Aluminum-sheathed steam plant's bold masses, upper right, make an impressive view from highway. The conveyor rises in foreground from a coal crusher unit.*

*Spotless interior of plant shows precast-concrete slab roof, tile floor, aluminum and glass control room. One set of controls governs each pair of generating units.*

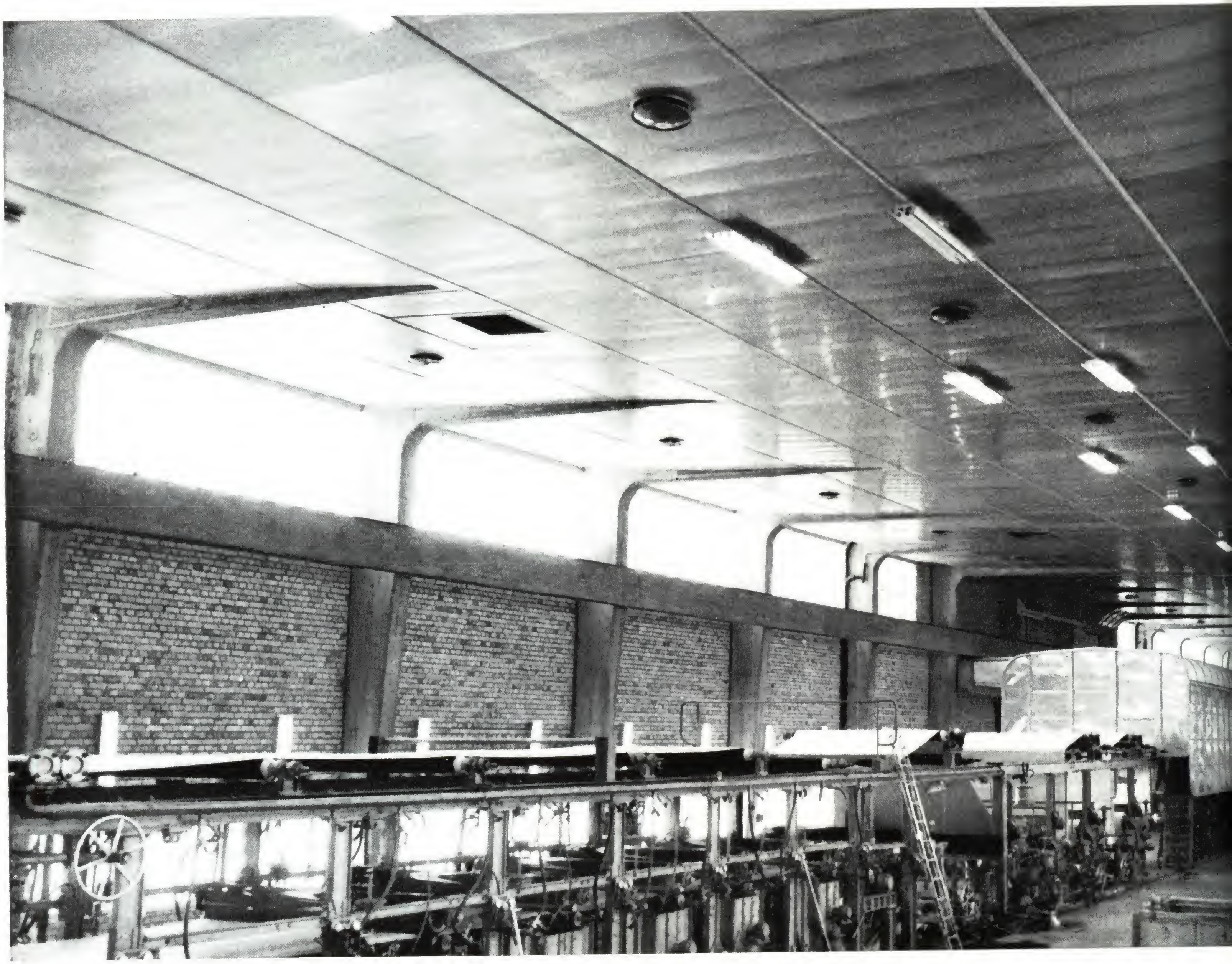
# OSTANFORS CARDBOARD FACTORY

Ostanfors, Sweden 1953

Ralph Erskine

The requirements of pressing water-carried pulp into cardboard by a continuous straight-line process have here resulted in a unique industrial building form. The architect has made each element of his building work for the total process with the precision of the machinery it houses. The result is a factory exterior of great originality.

Brick has been handled with a flexible grace that recalls the architectural masterpieces of Baroque city building, but the curved walls represent a



functional solution. The curved wall towers accommodate the ventilating machinery, here placed at either side of the main factory aisle to provide the enormous quantities of hot air used to dry and form the wet paper pulp. Where extra building width was needed to accommodate equipment at the wet end of the plant, the architect again curved the brick wall outward, freeing it from load by cantilevering the beams supporting the light concrete roof slabs. Aluminum ceiling, shown below, is huge hot air duct.

*Curved brick wall sections of Scandinavian factory building, above, provide space for ventilating machinery. Air intake ducts turned down to keep out the snow and set in a bold pattern against the curved wall, here become a major decorative element.*

*Factory ceiling at left is a huge hot-air duct, planned to prevent condensation from the wet process on building walls and ceiling. This would mean not only frostbite damage to building but also possible drip damage to the product. Heated air flows between slab roof and suspended ceiling. Made of aluminum, this ceiling is curved to increase daylight reflection in central factory aisle. This is a considerable plus in Sweden, for daylight is reflected from snow-covered ground through an extended winter.*

# DONNER HALL DORMITORY

Carnegie Institute of Technology

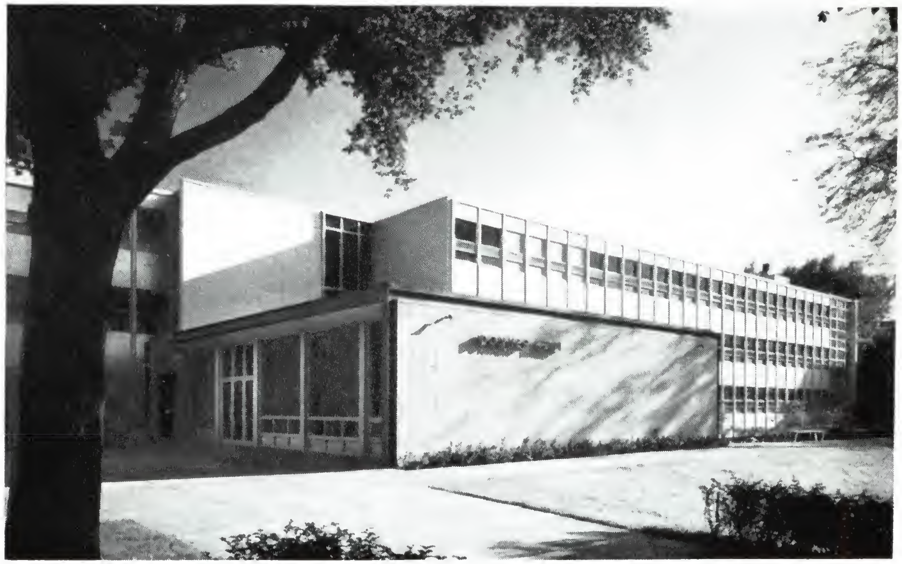
Pittsburgh, Pennsylvania 1954

Mitchell & Ritchey

That most universities teach one kind of architecture and build another is a fact. The reason is clear: while the faculty decides what to teach, it is the Board of Trustees that makes decisions on what to build. This new dormitory building is an exception. It has the clean contemporary design taught in most U.S. architectural schools.

Built within a tight budget, it uses a novel and economical aluminum panel system. The panels are flat 0.125″ sheet aluminum formed into an inverted pan 2″ deep, braze-welded at the corners. This rigid, even panel, prefabricated without necessity of casting or stamping, plus ease of erection from a single plank scaffold, contributed much to lower costs.

The attractive wall has a subtle but effective blend of colors. Aluminum panels have a chemically etched, frost-white surface contrasting against gray anodized aluminum mullions, trim, cover cap and window walls. These colors in turn harmonize with green ceramic tile end walls and the blue-green glass.

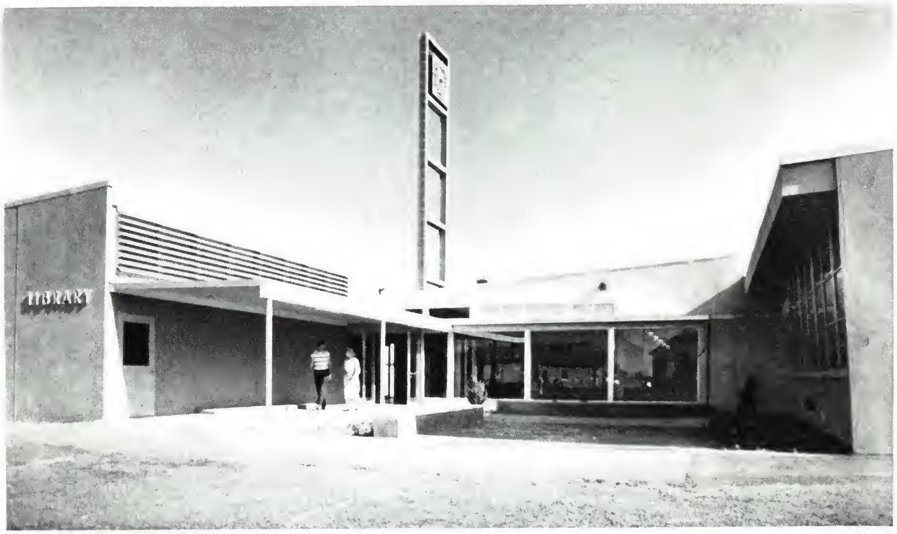


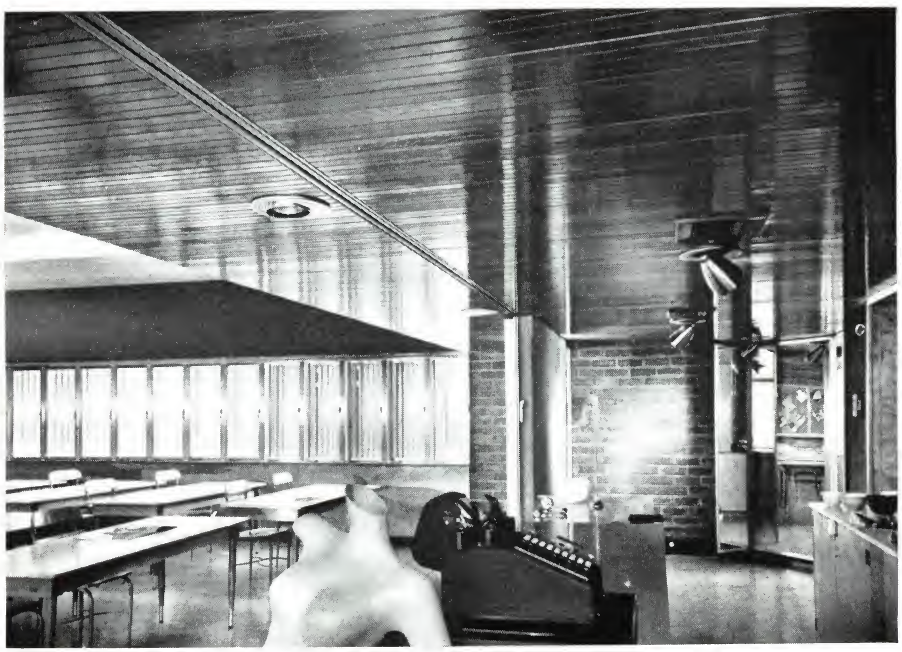
*Approach to sleek, new dormitory, above right, shows ceramic tile wall at entrance, aluminum panel wall system with aluminum mullions and windows at wing.*

*Aluminum was key building material in the plan. Interior uses include stair rails, main lighting fixtures, hardware, thresholds and even bench standards.*

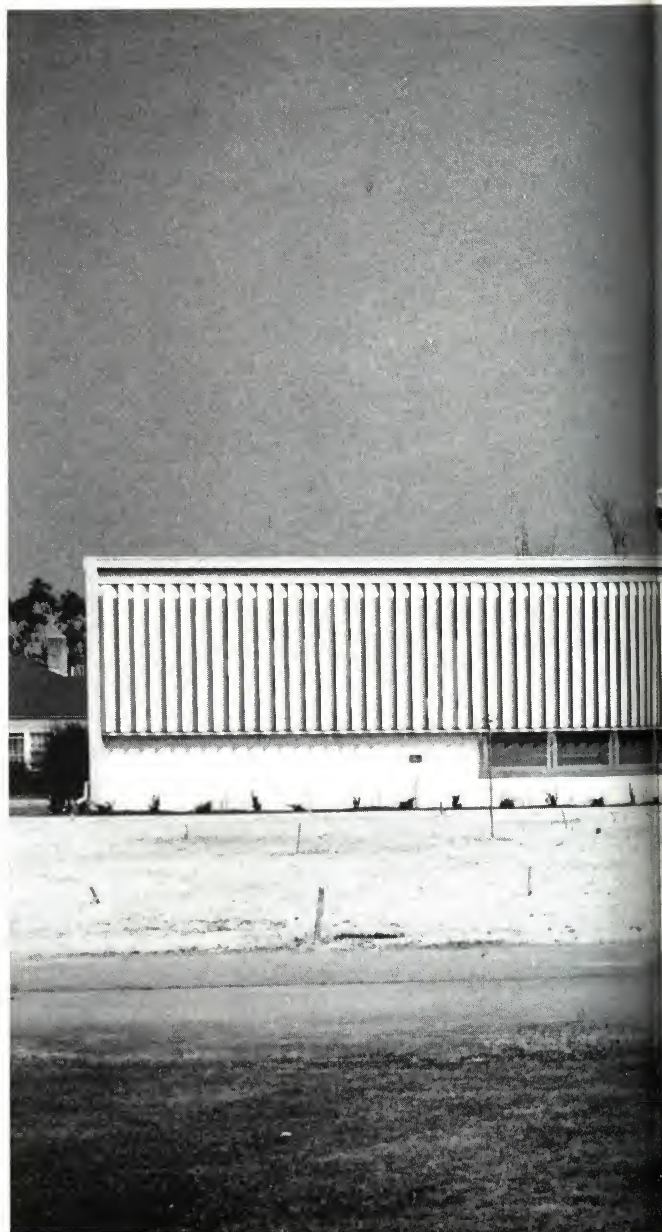
*Wall system, left, is self-flashed, has specially designed flanges on aluminum spandrels and mullions, providing expansion joints that eliminate flashing, caulking.*

*Library building, directly below, with a campus clock tower uses simple structural forms for an informal rather than monumental appearance. The window sash and louvers are aluminum, as well as ornamental lettering at end of building. Interior of Technology building, next below, shows vertical, interior aluminum louvers for built-in light control. Other aluminum uses include: mullion covers, ventilating louvers, flashing, gutters, spandrels and special features such as showcases and aluminum roll-up slat doors. Photo at right is an end view of the Student Center building.*



The three handsome buildings pictured on these pages are part of a 15-year building program for a public junior college in the rich oil and agricultural district southeast of Los Angeles. Architect Robert Alexander prepared a complete campus plan which utilizes a few existing buildings on this one-time Army Air Base. He designed the campus on a generous scale based on long range data submitted by the faculty. Their forecasts added up to an anticipated student body of 1500 by 1964. Most of

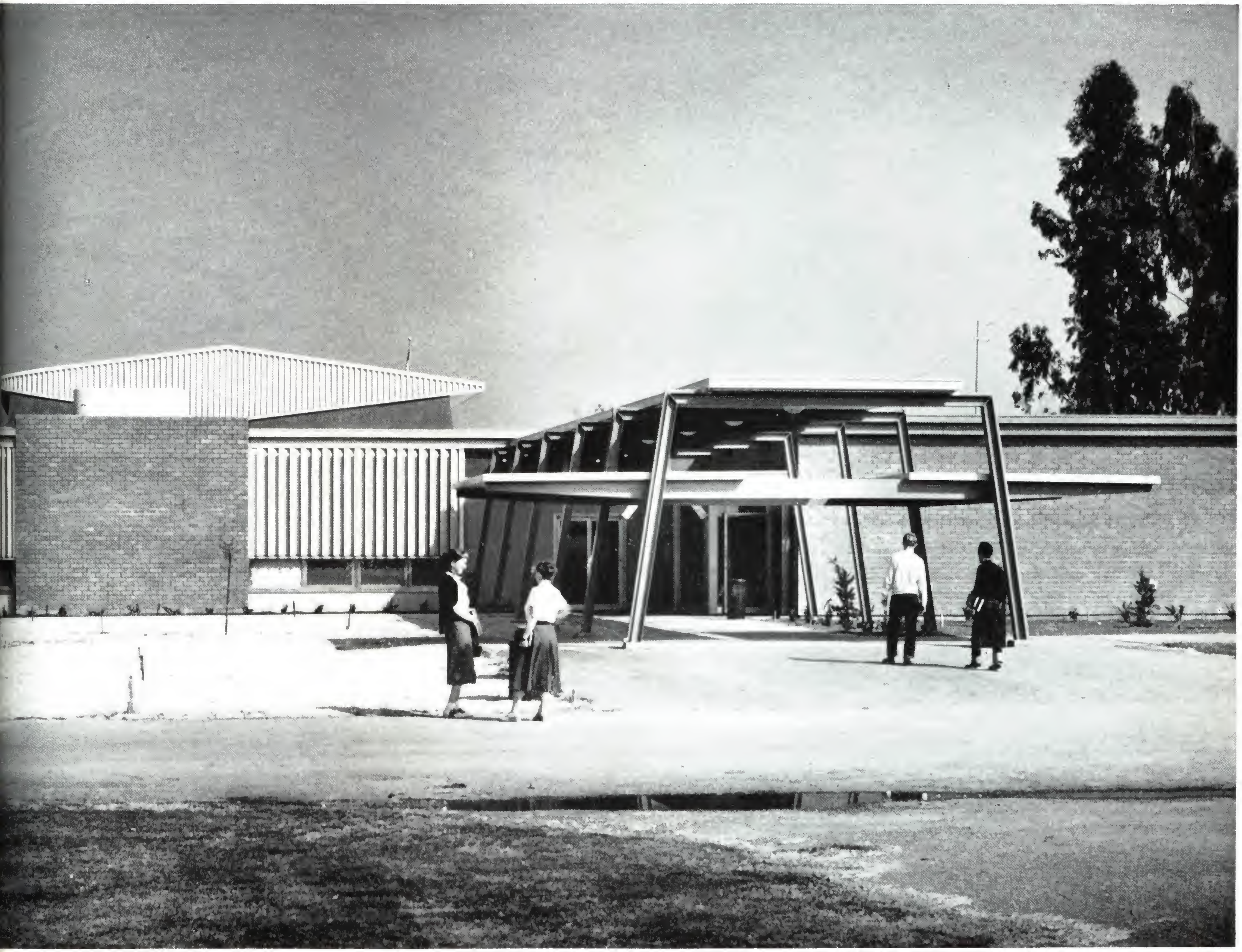


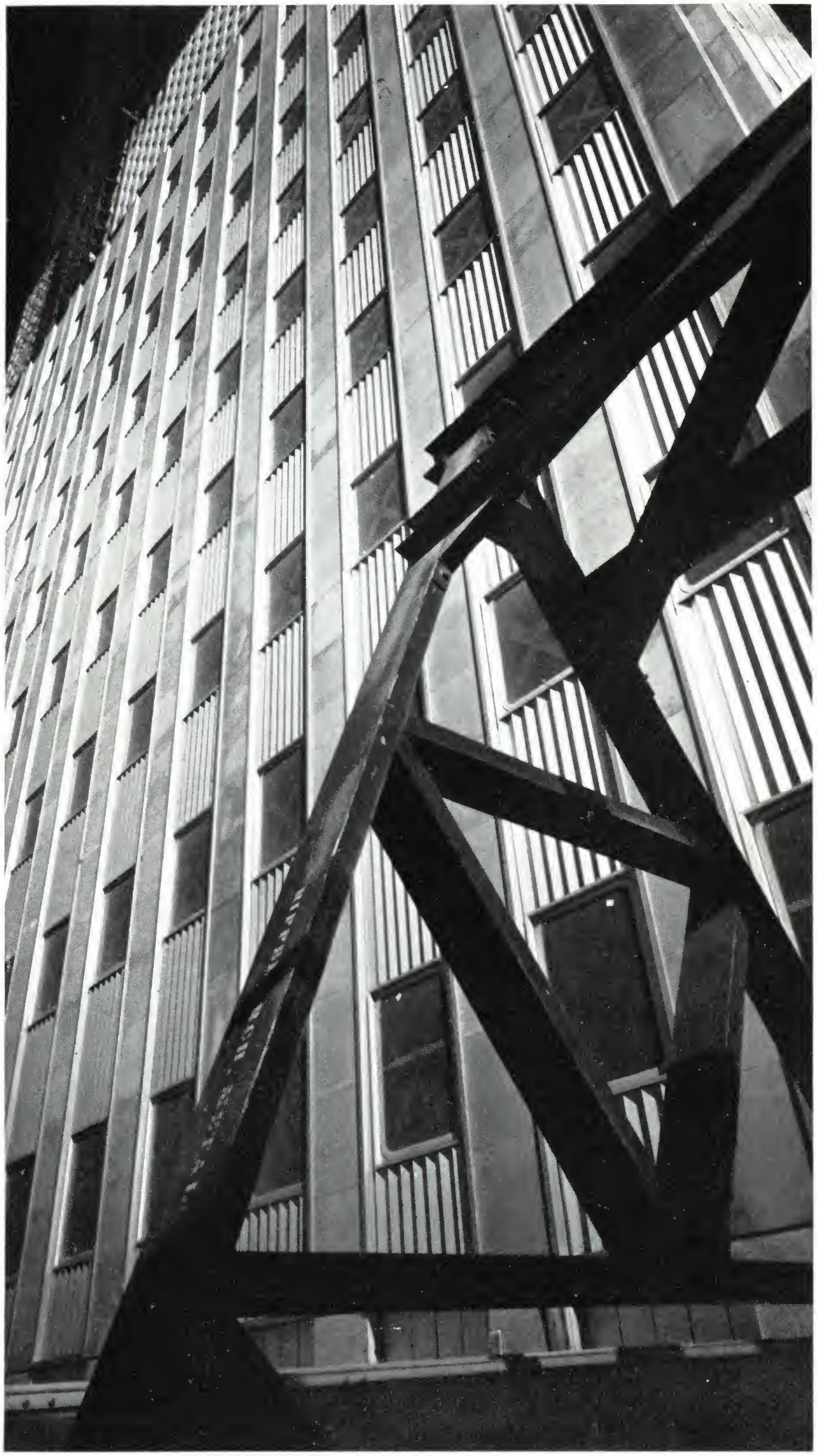
the completed buildings are concrete-framed, with concrete floor and roof slabs and masonry walls of brick cavity construction. The architect, with easy maintenance in mind, used unpainted aluminum for as many details possible, carefully selecting an alloy suitable for this coastal location. Principal uses include: window sash, doors, interior operatable louvers and ornamental lettering. After several years, he reports that the aluminum has weathered to a pleasing shade of grey, much to his satisfaction.

## ORANGE COAST COLLEGE

Costa Mesa, California 1946–

Robert E. Alexander





# PRUDENTIAL BUILDING

Chicago, Illinois 1955

Naess & Murphy

Chicago's newest, biggest office building—and the first one of any size to go up in that city since 1934—bows to no other in combination of sheer size and services. In general appearance, the 41-story, $41 million mass of limestone and aluminum rising between the Loop and Lake Michigan is roughly contemporary with the earlier Rockefeller Center in New York. Even more massive than the RCA building there, it dominates its skyline with all the solidity and permanence of the Prudential Insurance Company's trademark, Rock of Gibraltar. Gross floor area of 1,763,000 sq. ft. includes block-size first and second floors with lobby, shops, restaurants and garages. Above these are eight floors with 44,000 sq. ft. of net rentable space each—ideally suited to the huge, unbroken clerical areas needed by the Prudential Insurance Company itself to house its mid-America regional headquarters. The tower floors (11–38) offer the Prudential's tenants unusually large net areas of 20,000 sq. ft., well-lighted, air-conditioned and serviced by more and faster elevators than most major office buildings.

*Between limestone-faced piers running the full height of the building are 7′ high spandrels of 1/8″ fluted aluminum panels, double-glazed aluminum framed windows that pivot vertically for easy inside washing.*

*Seen across the railroad yards from the lake, right, the north side or "back" of the tower shows a service tree of elevator shafts, fan rooms and washrooms pulled out to leave office space free and flexible throughout.*

# PHILADELPHIA INTERNATIONAL AIRPORT TERMINAL

Philadelphia, Pennsylvania 1953

Carroll, Grisdale & Van Alen

An air terminal is a problem in traffic. This Philadelphia airport is distinguished by a skillful recognition of the specific needs of passengers and the ubiquitous visitor, as well as the generally recognized requirements of aircraft, trucks, busses and autos. The architect planned a great central public area through which all passenger traffic is smoothly channeled to a pair of long horizontal finger concourses. This layout also provides an admirable solution to the multiple requirements of the various airlines, concessionaires and federal agencies.

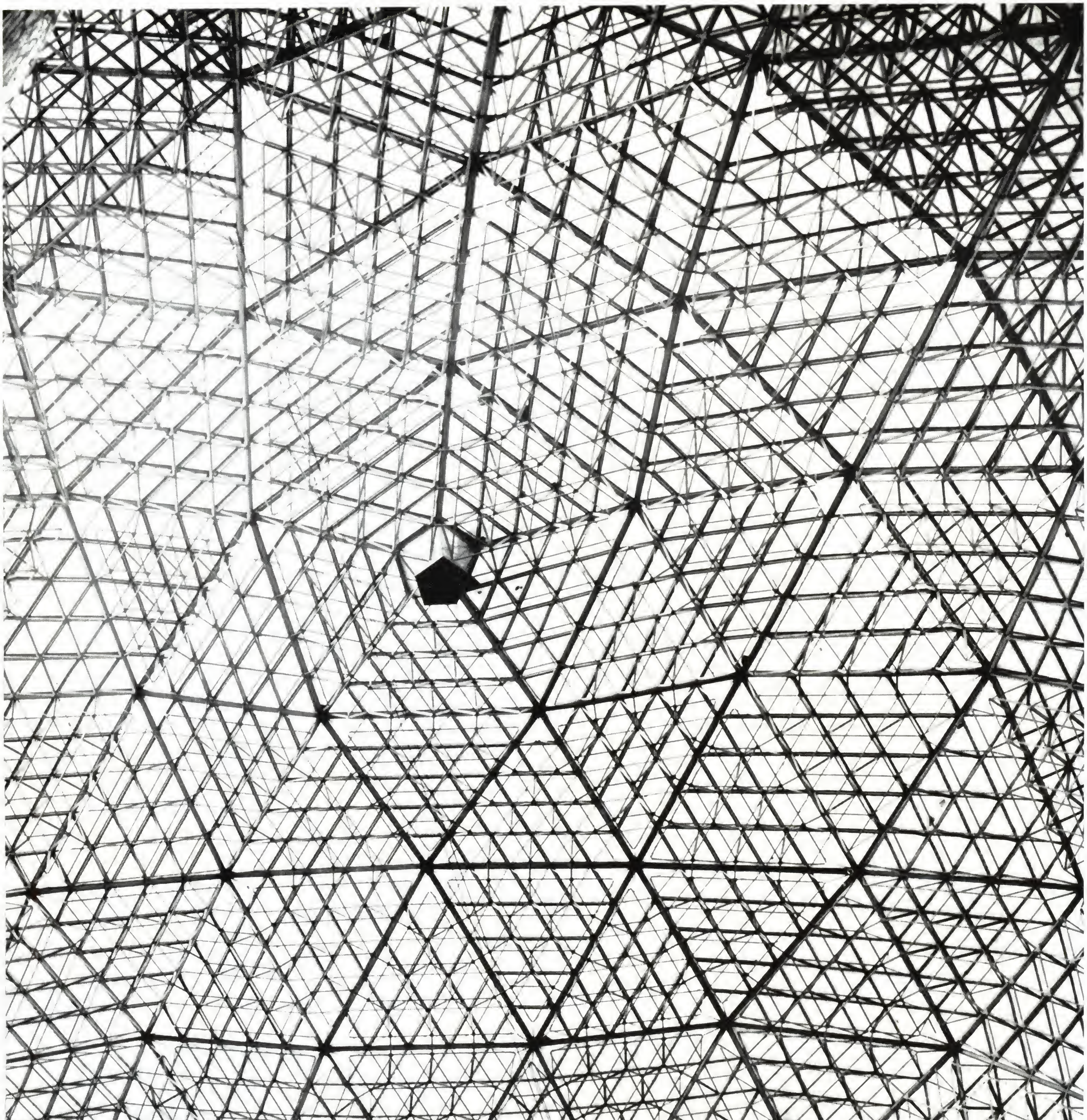
Throughout the buildings, aluminum is used impressively in over 60 major and minor details. Besides many standard uses such as sash, storefronts, gutters, doors, spandrel panels, hardware and lighting fixtures, two other applications that feature its light weight are shown in the photos at right below. One is a series of covered walkways which are all aluminum, using bent pipe sections for the structural supports with 6″ aluminum I-beams and stock corrugated roofing panels. The other is two tiers of sunshades on the south side which employ aluminum both for the louvers and structural members.

*Main passenger entrance to terminal lobby has curved, 400′-long platform, protected by a cantilevered concrete canopy 28′ wide with columns spaced 24′ o.c. Aluminum was used for sash on window wall and for corrugated siding on small entrance vestibule at sidewalk.*

*View from flying field emphasizes impressive 900′ sweep of one of America's best-planned air terminals. Aluminum was used for all sash on main building, as well as on two 500′ finger concourses at left and right. Two additional fingers can be added if expansion becomes necessary.*

*Long ramp passageway leading to observation deck from parking field at front of terminal has light-weight, all-aluminum canopy made up of corrugated roof panels, 6″ I-beams and aluminum pipe supports.*

*Sunshades on south side of terminal use stock aluminum mesh supported by aluminum bars, channels and "T" sections fastened to steel angles in concrete structure. Spandrels are 1/8″ sheet aluminum.*



# FORD MOTOR COMPANY ROTUNDA BUILDING

Dearborn, Michigan 1953

R. Buckminster Fuller, *Designer*

H. Sanborn Brown, *Architect*

The webbed structural pattern shown in the photograph at the left has become increasingly familiar to architects and architectural students across the U. S. Its designer, Buckminster Fuller, probably one of the most prolific idea men in modern architectural engineering, has traveled afar challenging the set practices in structure and form.

While it may look different, there is nothing quixotic about this dome on the Ford Rotunda. The structure was a practical solution to a problem. The old Rotunda Building would not carry the load of a 160-ton conventional dome of steel, but it could easily carry the 8½-ton geodesic dome of aluminum. It went together easily and quickly. The 19,680 five-ounce aluminum struts, none over 3′, were assembled in only 30 working days. This is an example of a revolutionary technique what Fuller calls the aircraft building technology. All on-site dimensioning and fabricating were avoided and the many identical and interchangeable parts were factory cut and drilled to tolerances of 0.005″, an exactness heretofore unheard of in the building field.

The basic unit assembled on the floor was a triangular truss 2½′ in depth, consisting of 123 struts. These were cold-riveted together. Easily portable by one man, the trusses weighed only 65 lbs. each. Erection was similar in principle to the dome shown on page 138. The structure was assembled top first, and as each successive ring of trusses was completed, jacked up hydraulically on a central mast.

*Aluminum web of dome spans 93′. An addition to existing Rotunda Building, its light weight of 8½ tons was a necessity. Dome is covered with plastic.*


*The Rotunda Building is hub of Ford Motor Company's Dearborn office. The dome nestles over the inner well at top of rotunda and can be viewed from interior. Though structure of dome appears complicated, struts were assembled quickly using relatively unskilled labor. Each strut was marked with identifying colored tapes.*

# NORTHLAND SHOPPING CENTER

Detroit, Michigan 1954

Victor Gruen, Associates, Inc.


*Northland's complex of stores, malls, courts and terraces has exterior planning as thorough as the buildings themselves. View from entrance roadway shows, at left, part of 7,500-car parking area, wing containing smaller shops, and Hudson's large, branch department store, center.*

As a recent and purely American phenomena, shopping centers are cropping up in every major city across the country. Our proudest example covers some 163 acres and lies 10 miles from the center of downtown Detroit. Northland, widely admired as the first modern commercial center to use the "market place" idea, holds a host of records. For example its commercial heart, Hudson's Department Store with 470,000 sq. ft. of floor area, is the biggest branch department store ever built. Then there are the 80 surrounding shops whose store fronts add up to over one and a quarter miles. Each individually designed for the tenants with the approval of master planner Gruen, they represent the largest single installation of aluminum storefronts in the world.

Another handsome and imaginative use of aluminum is the fence barrier beside the main entrance road. Its side panels consist of a standard aluminum grating, unpainted for easy maintenance.



*Ramped bus road to entrance of department store, top left, is lined by a fence barrier made up of stock aluminum grating panels fastened to steel upright supports.*

*The storefront, top right, with colorful arrangement of panels, is framed in black-anodized aluminum. Design of storefronts was handled by the tenants.*

*Northland Shopping Center represents the largest single installation of aluminum storefronts ever made. Side-by-side, they add up to the building frontage along 35 blocks of New York's famous Fifth Avenue.*

*Permanently open pavilion, part of indoor-outdoor garden-shop, is roofed with light aluminum slats to protect plants from heat of the sun. The framing is Y-shaped bents 7′–8″ at columns, 11′ at tips of Y.*

*In this vastly horizontal spread of school buildings, auditorium-cafeteria complex is at left, classroom and administration block at right. Classroom and administration wing is a mammoth 800′ in length. All fenestration uses aluminum, as do roof details like fascias and gravel stops.*

# OAK RIDGE HIGH SCHOOL

Oak Ridge, Tennessee 1950

Skidmore, Owings & Merrill

The first permanent structures built for the Atom Community of Oak Ridge, Tennessee, were this high school and its adjacent, 1,500-seat auditorium. Because the new town was in serious need of all sorts of community facilities, these buildings were designed to serve numerous purposes beyond those of an ordinary high school.

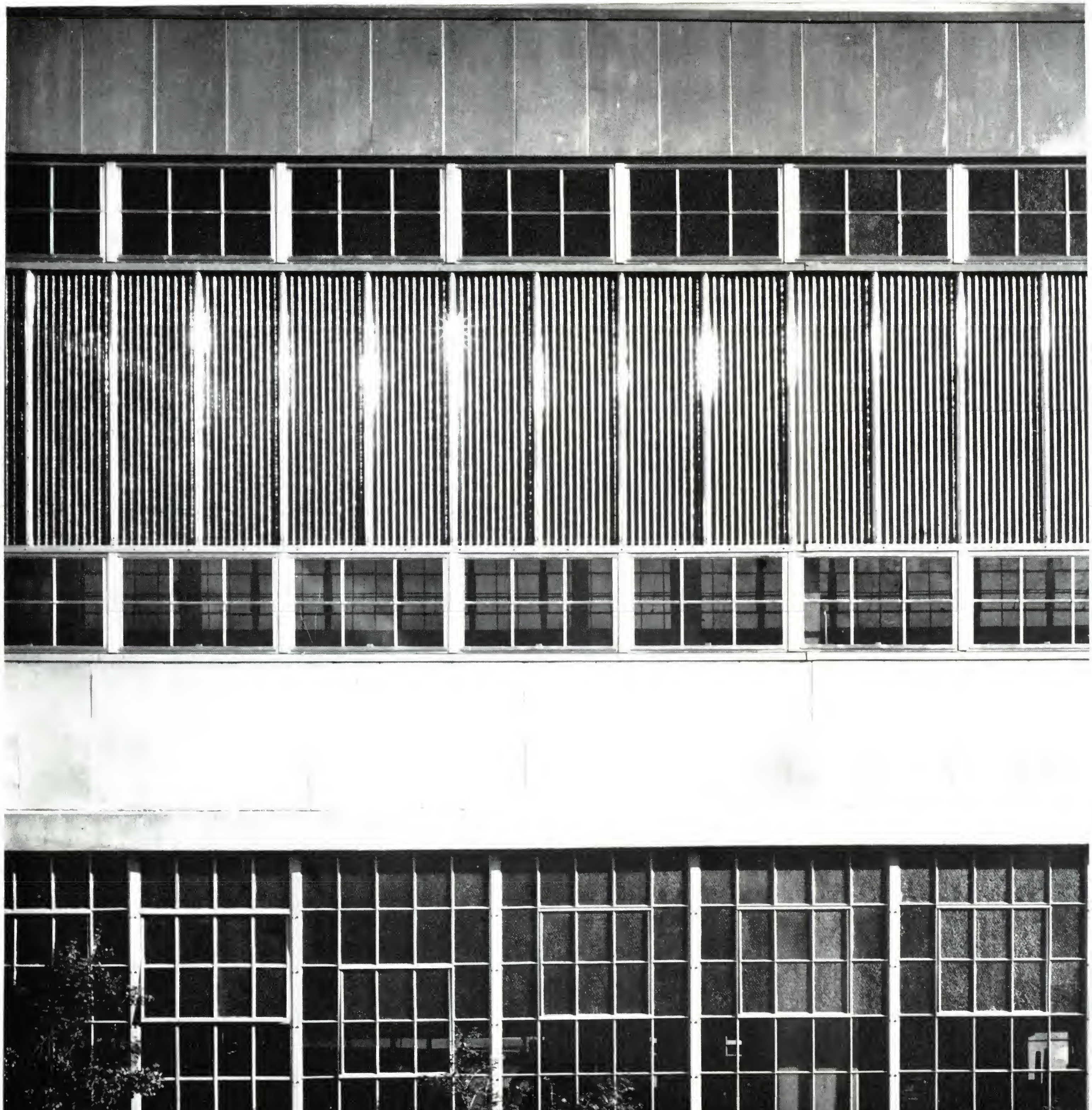
So, for example, the 500-seat cafeteria, like its adjacent auditorium, is now used by various community groups. The gymnasium, too, is available to adults at various specified times, as are many of the minor services within the school complex.

Such additional community needs tended to produce a decentralized plan of semi-autonomous buildings capable of being used while the rest of the school is closed. These separate buildings are linked by long, glass-enclosed passages, one of which is shown at right. Its fenestration, like that of the rest of the building, uses aluminum frames and sash; its hand railings are of aluminum tubing.

This is a typically well-planned modern high school but for its exceptional size and the completeness of its facilities, designed for an ultimate enrollment of 1,500 students. The school has one 800′-long classroom and administration block, an arts. crafts and drama department with appropriate shops and classrooms, and the auditorium, cafeteria and gymnasium structures already mentioned.

In the master plan prepared for Oak Ridge, this high school forms part of a huge administrative town center, now under construction, and adjoins the 100-acre shopping center tract that will some day become the focal point of the entire community.

*This detail of the glass-enclosed corridor between classrooms and auditorium block shows neat, tubular aluminum hand railings which are used throughout the building.*



# ELECTROLUX CORP. PLANT

Old Greenwich, Connecticut 1951

Raymond & Rado

This neat-looking plant embodies some very clean designing to solve a complicated transport and materials handling problem. The architects cleverly designed the building to fit into a slope to handle trucking shipments at ground level, rail shipments at the level above. Manufacturing occurs on ground level, warehousing of raw-materials, parts and products above. Warehouse space is designed for conversion to manufacturing in the future.

All this could take place in a dull-looking box. But the architects used their operating windows, fixed wire-glass and insulated aluminum panels to create a remarkably rhythmic and interesting façade. Aluminum was chosen for sash and panels to minimize maintenance and to impart a sparkle, seen in view at left, especially appropriate to a factory producing washing and cleaning appliances.

*Horizontal bands of pivoted aluminum sash alternate with vertically accented aluminum insulated panels or corrugated wireglass in aluminum frames, give pleasing rhythm to this factory façade. The close-up at left shows detail of the factory's north façade, a sparkling composition in aluminum and blue glass.*

*Top picture at right shows trucking depot at the west end with a view of the long north side. Aluminum door, below, is on side where rail shipments enter. Aluminum parts stand up well in this coastal climate.*

## NATIONAL HOMES

U. S. A. 1955

Charles Goodman, *Consulting Architect*

*Canterbury gains bigness from roofs of carport and patio. There is no back door; entrance and patio confine outdoors activities to front area.*

For well over a half century residential prefabrication has been a growing promise. Few things have contributed more to make it a glowing reality than the well designed National Homes of Architect Charles Goodman. The moderately priced, three-bedroom Canterbury shown on these pages is typical of the some 53 models that come rolling off production lines in three regional factories.

They range in size from 705 sq. ft. up to 2000, are completely varied in design, and have the smartly styled features which have all but erased the "pre-fab look" once associated with factory built houses. In the Canterbury, as in all of the larger models, indoor-outdoor living is emphasized by large aluminum windows and a convenient patio. The brick chimney, the gently pitched roof and crisp simple lines satisfy a full range of tastes, from modern to traditional.

Mass production of homes by necessity requires appealing, but thoroughly tested, labor-saving materials. Aluminum nails that never rust and require no puttying, awning windows and screens as well as aluminum hardware throughout save time in the factory and offer maintenance savings to the customer. These homes are typical of the styling and standards that now enable prefabrication to market one out of every ten new houses in the U. S.

*Close-up shows typical detailing of end wall. Two examples of economies in factory producing wall panels: nailers simultaneously nail each end of studs to plate at rate of 20′ per min.; opening for aluminum window is cut from panel in 35 seconds.*

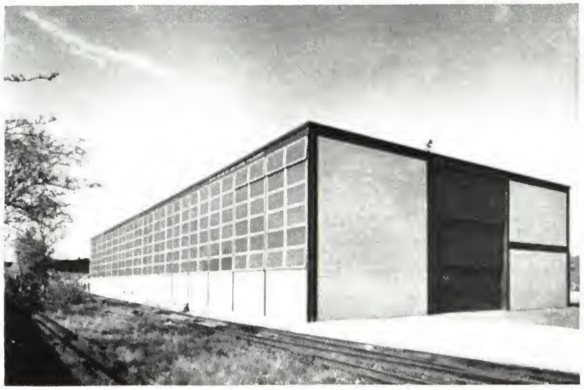
# ILLINOIS INSTITUTE OF TECHNOLOGY

Chicago, Illinois 1940-

Mies van der Rohe

*Mies provides a plan of classic orderliness for pure modern buildings whose structure is revealed with Gothic straightforwardness. Elegant detailing is based on technology of materials in a subtle organization of steel structure, brick and aluminum. The structure is the decoration. Buildings shown above are: Alumni Memorial Hall, left; Chemical Engineering and Metallurgy Building, center; and Chemistry Building, right.*

*Different buildings show how variety was achieved within framework of given style. Upper left, Association of American Railroads Laboratory has large glass area set in standard aluminum sash. Chapel, upper right, has roof-high fixed glass panels on east and west, vented in horizontal strip above doors. Steel roof beams are left exposed for simple decorative effect on ceiling. Commons Building, at bottom, shows how Mies varies detailing of wall panels. Each brick and glass wall panel is framed by exposed black-painted steel structure. Street side of building is perfectly symmetrical, with broad plate glass areas and aluminum doors at the main entrance.*



The emerging challenge of modern architecture is not just the modern building but the relationship of one building to another. Mies van der Rohe's campus plan in 1940 for the Illinois Institute of Technology is the pioneering work of a recognized master. His basic plan calls for 22 buildings, of which 12 have been completed to date. In addition to laboratories, shops, classrooms, auditorium, dormitories, the plan includes an apartment building for students and faculty and a shopping center.

Mies not only based the dimensions of his building on a standard module, but even their location on the building site. Using a basic module of 12′ x 24′, Mies dimensioned and placed buildings so that late additions could be made without interrupting the rhythm of the basic pattern. The 12′ x 24′ module was, of course, also used as the basic dimension for building wall panels of brick, aluminum and glass on all buildings.

Typically, the superb detail design has been as widely admired as the general plan. Black-painted steel structural elements are fully revealed against the buff-colored brick for elegant decorative effect. Aluminum window sash was specified throughout.

## M.I.T. AUDITORIUM

Cambridge, Massachusetts 1955

Eero Saarinen & Associates

*This dome is one-eighth of a sphere, self supporting. Interior space made possible could be applied to a variety of building purposes.*

This shell of thin concrete, ballooning up like a graceful sailboat spinnaker on the Massachusetts Institute of Technology campus, has stirred enough talk to suggest its importance in the changing stream of architecture. It is a striking piece of engineering: a tricornered dome (one-eighth of a sphere) spanning 155′ and touching its 1,500 tons to earth on only three pinpoint buttresses. But even more, it is a dramatic reversal of the "form-follows-function" dictum that has both helped and hindered architectural thinking. Instead of determining efficient shapes for audience and acoustics and then fitting a tight building glove around them, Saarinen reached for a more universal shelter-form and then accommodated the particular functions of an auditorium underneath it. One rounded corner serves well as a stage, with the auditorium widening out through the audience to an aluminum and glass-enclosed lobby curving across the opposite side.

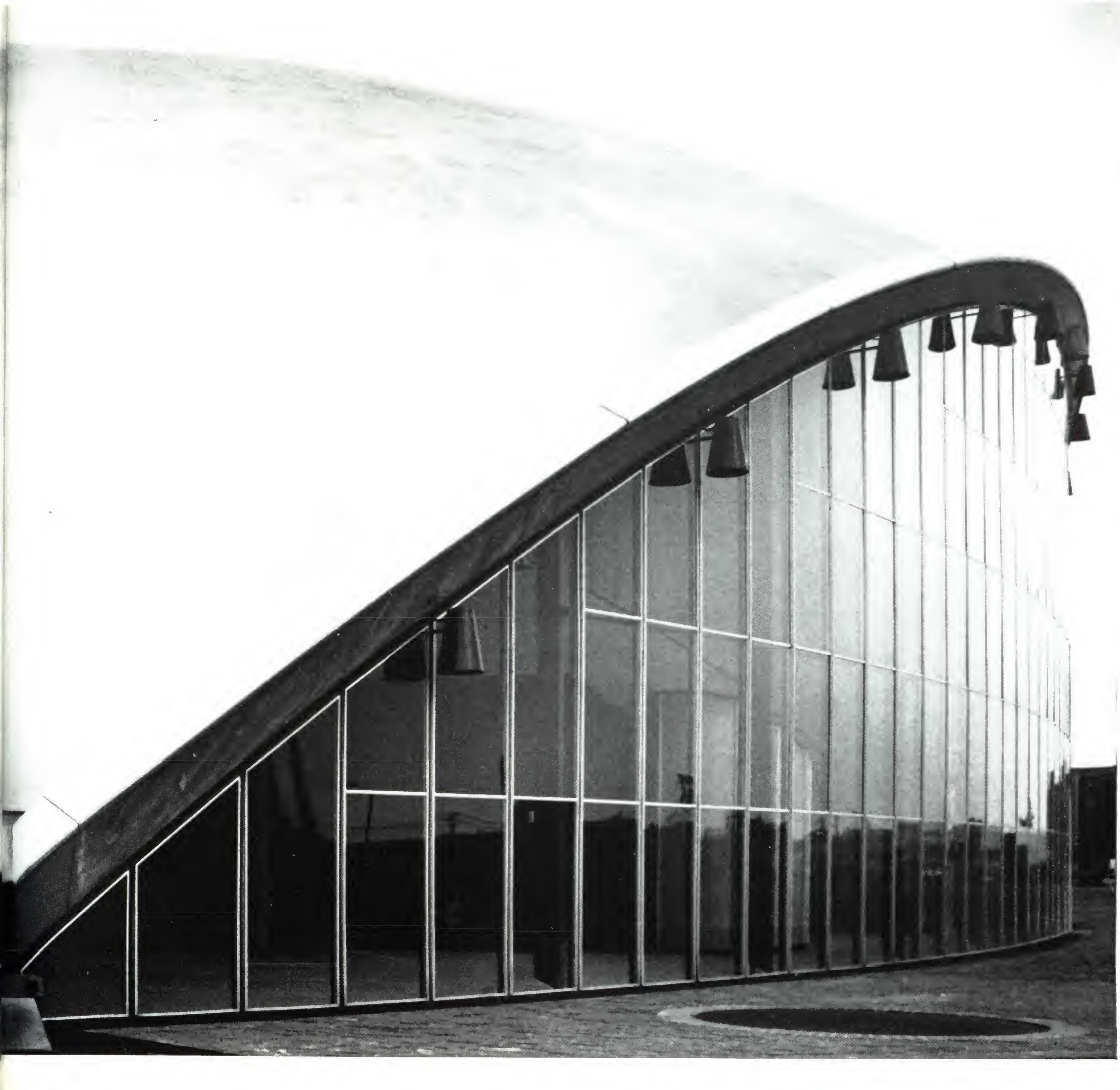
In conceiving his design, Saarinen spent much time and effort in relating the building to its environment. In selecting this building shape he intended that it would contrast but still have certain bi-relationships with the surrounding buildings on the campus. As the American contemporary style develops and grows, Saarinen feels the architect should concentrate more and more on the total look of our cities rather than the single lone building. Current projects and future projects now on the boards across the country indicate that this kind of thinking is becoming increasingly widespread among the many forward-looking architects.

*Tricornered dome seen at the left rests on three buttresses with no interior vertical supports. Light aluminum window framing contrasts with concrete shell roof.*

*One of three arched curved walls, this is at lobby side. Building contains large, main auditorium on ground floor, compact circular auditorium in the basement.*

M. I. T. AUDITORIUM

*This thin-shelled structure is representative of both the founding premises of modern architecture and its continuing search for new forms.*




*Edgardo Contini*


*Mario Ciampi*


*Eero Saarinen*

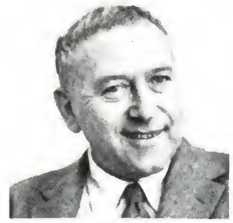

*Gordon Bunshaft*


*Mies van der Rohe*


*Robert Alexander*

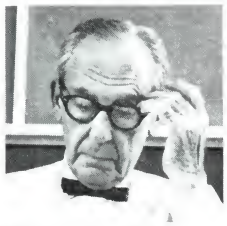

*Ernest Kump*

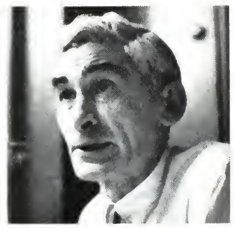

*Fred Severud*


*Marcel Breuer*


*Carl Koch*


*Buckminster Fuller*


*Walter Gropius*


*Charles Goodman*


*L. L. Rado*

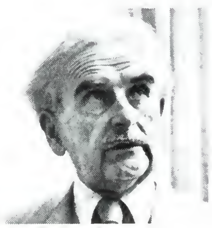

*John Peter*


*Welton Becket*


*Raphael Soriano*

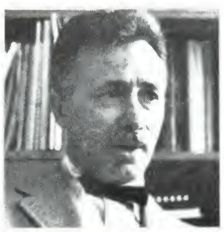

*Philip Johnson*


*Bruce Goff*


*Richard Neutra*


*Philip Will, Jr.*


*Paul Weidlinger*


*Pietro Belluschi*


*I. M. Pei*


*Craig Ellwood*


*Eduardo Catalano*


*Donald Barthelme*

*Certainly the age of light metals has only begun. The hundred and one buildings pictured on the preceding pages evidence an impressive start. As a matter of fact, they even provide some pretty clear clues to the architectural future. Convinced, however, that the real future of aluminum in modern architecture can best be gauged by the architects who create modern architecture, the authors traveled the U.S. to tape record the opinions of some twenty-six of this country's important architects and architectural engineers.*

*Their opinions were completely frank and unsolicited. It is safe to say that all saw an increasing use of aluminum in architecture. It is equally necessary to say that many qualified their thoughts with the reminder that aluminum was only one of the important building materials of the future. Specifically, their opinions are as varied as their architecture, but here, among their word-for-word recorded conversational comments, is certainly one of the best spots to appraise the true place of aluminum, as well as the future of architecture.*

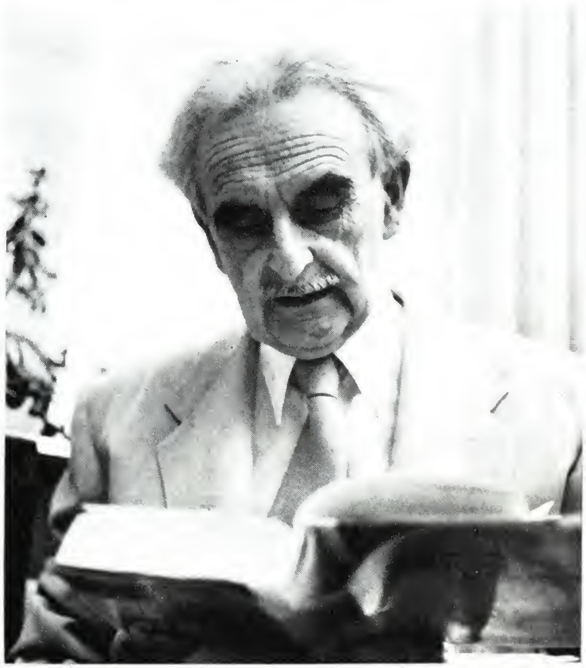
## RICHARD J. NEUTRA

..... I do not think that our civilization should be characterized by one or the other building because it is an age of mass performance. I wouldn't say that every wonder is an eleven-day wonder but I think that the most interesting part of a step is that it leads to the next step. The sequence or evolution is more characteristic of our technical development; that holds also true for architecture.

..... I would say that aluminum is the lightest material which has entered the architectural mind. When I was a boy I first heard about aluminum. It was a precious metal. It was at that time first produced in laboratory quantities. It immediately captured my imagination. For a long time people have been extremely happy to claim heaviness and weight as a virtue and merit of design. I was quite in opposition to the idea that architecture should be measured by the pound or by the ton.

On the contrary, I thought that if you could make it extremely light, it would be something of our own and would be quite in keeping with a quickly-moving civilization. The idea of having light, structurally strong materials, I would consider, is typical, significant and almost descriptive of our endeavor in architecture.

Of course, there is no doubt that the most precious of all materials .... even including aluminum .... is the human material which has been recommended as an object of study by many philosophers for the last ten thousand years. While this recommendation looks so gray with age, it is extremely green and new. The architect who really designs for human beings has to know a great deal more than just the five canons of Vitruvius.



*"The architect . . . has to know a great deal more than just the five canons of Vitruvius."* RICHARD J. NEUTRA

## WALTER GROPIUS

Much I have learned from the practical men in the field, the foreman and the clerk-of-the-works. Designing a building needs a clear conception of the practical process of building it. So the architect should be well trained in the techniques of building and the know-how in the field. Among these techniques he should be made familiar also with the specific qualities of aluminum. Of course, the field of building techniques is so large that one man cannot know all the details and processes, but he should at least become familiar with the basic problems of the building materials and their new techniques; then he will know how to use them where they fit

"*. . . such a process goes much slower because the inertia of the human heart is too great.*" WALTER GROPIUS

best. I would not use aluminum in a place where another metal, or another material, may be more appropriate from an objective point of view. That objective attitude will then have as a result that aluminum will be shown in the most appropriate places where it belongs.

Prefabrication will be the future in building, I believe. I am rather proud that, as early as 1910, I had written on prefabrication in a sense which meanwhile has come true. At that time I still thought that, within a few years, everybody would accept this new industrial building method, but today I see how slowly such a process of change has gone because the inertia of the human heart is too great. Particularly in a period where everything has changed, not only the methods of production, but also our thinking, man tends to cling to the visible things he has inherited from his grandpa. He does not easily let go. Therefore, prefabrication has not become a sudden revolution which might have included the danger of over-regimentation, but it is a slow evolutionary process, taking one part after another out of the hands of the craftsman and putting it through the industrial process. People have been afraid that we may end up with sterile unification of our buildings. However, the natural competition in the market will result in building parts with a great variety of appearance even though they are made to the same dimensions. Nor will the architect be thrown out of the market, because designing a building from ready-made component parts which are to be assembled needs just as much imagination and skill as the design of a building constructed in the old way in brick or stone.

I observed recently that prefabrication today has already penetrated further into skyscraper buildings than into residential buildings. Take a building like Lever House in New York; 85 to 90% of the building consists of component parts made in factories, brought to the site and assembled there. Prefabrication is a slow but continuous process. When you open *Sweet's Catalog* you will find that a great many component parts are already available from industries. The architect, however, has not been active enough in this development. He has left it to the engineer and the scientist to design such component parts. He should go into industry and design them himself.

## BRUCE GOFF

. . . . . Aluminum has the property of lightness of weight. I believe that in modern architecture we are striving more and more for the light and athletic feeling rather than the heavy, cumbersome work of

"*In modern architecture we are striving more and more for the light and athletic feeling . . .*" BRUCE GOFF

the past where weight was the main consideration and design was gotten by massiveness and effect of light on mass and material. I think it is much the same difference between an elephant and a dragonfly where we think of architecture of the past being more of a weighty matter and today's as being light.

Now, if we are able to develop this light athletic feeling in design, we naturally must have the cooperation of light materials, not only in physical weight but in appearance . . . . . the visual aspect such as color, texture and so on.

I believe that aluminum should be used structurally, as well as a skin—possibly as both together. A long time ago, in fact in 1930, I designed a fraternity house which was never built. It was to use insulated aluminum panels. The idea was to have a light aluminum frame with removable modular panels of diamond shapes that could be set in with sort of a clip joint fastening. At that time I was told that aluminum was for pots and pans, as any fool should know, and that it was not a building material.

## ERNEST KUMP

. . . . . Of all the metals, I think aluminum has the characteristics that best fit the trends in the development of better materials for architectural purposes. Its characteristics as a material impress me most, because I believe the great trend in materials of architecture is toward those with the highest strength-weight ratio, those that lower the weight with respect to strength. What we can do in reducing deadload all ties in with making a higher standard of building. To me that is the most impressive thing about aluminum.

Architecture is beginning to take up the trend of economic philosophy of mass production, prepackaging, pre-development or, as we call it, prefabrication. This latter has been a bad word in architecture. But almost everything we have today in this country is prefabricated. We buy our predesigned cars, our factory-made clothes. We don't want a custom tailor any more. I believe the custom architect is going the way of the custom tailor.

This will broaden the whole aspect of the demand for architectural talent.

We see it out here . . . industrial buildings have now become packaged commodities and standardized designs. The only way we can raise the standard of architecture for most people is through the same techniques used in producing our food, clothing, transportation, etc. I believe we are going a step further than module parts. I think the building is going to become the module. It's just an extension of the modular design from the small part to the panel to the whole wall . . . it's not going to be very long until we have standard modular buildings that can be adapted to any space use. It's going to make planning possible because you can't plan unless you have a basic unit with which you plan. Our demands or requirements in building spaces have become standardized by the very social development of this country. For instance, our automobiles, suits, clothes, dresses, etc., are designed to meet the needs of 90% of the people. The same thing has happened in architecture. They found that 90% of the people want the same space requirements. There is a common denominator that meets a very high percentage. The same in schools. The same with hospitals, industrial work, apartment buildings, office buildings. The important thing is how little the differences are.

*"What we can do in reducing deadload all ties in with making a higher standard of building."* ERNEST KUMP

## MARCEL BREUER

. . . . . If we get to the structural use of aluminum, that will be a great step because the material is so light. A structure always carries most itself, of course.

*"This old fight of man against gravity—to defeat gravity—is a very old passion."* MARCEL BREUER

The lightening up of the structure again lightens the load on the structure.

This old fight of man against gravity—to defeat gravity—is a very old passion. Man always wanted to go high and fly . . . . get away from the ground. This is in the old stories like Icarus and in the old dreams of flying. We have developed architecture from the pyramid, which is based on gravity, to, if you want to say so, the architecture of the airplane which completely defeats gravity. Architecture now often reveals something which underneath is light and above heavy. Yes, I would say one of the fundamental desires of the human race—to construct in defiance of gravity.

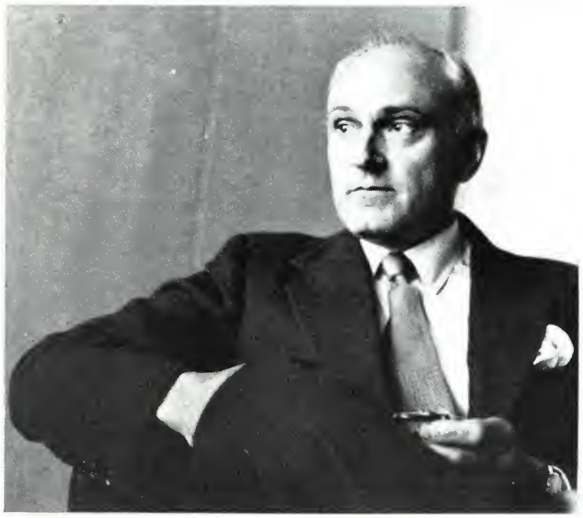
. . . . . While we design today individual buildings, we feel we should design, at least, a street . . . . . probably a district. Of course, to design districts or streets is another type of financing, another type of client than we deal with today. I think that the greatest future possibilities of architecture lie in city planning. I do not mean city planning is architecture, but architecture's solutions of city planning. Solutions which are large-scale solutions. Some beginning was done, let us say, on projects like Stuyvesant Town. I don't think that the project is a very good one, but it has an outstanding feature . . . . . they took the whole district and planned it together, which is a step forward. I wish that planning would have been better and the architecture better.

But I see the possibility of this type of planning on still a larger scale putting a completely new element into architecture. We won't speak about buildings, but about spaces between buildings. We will speak about squares and streets as a form of architecture, and not buildings as a form of architecture. The negative form, the space, will be the form of architecture and not the blocks and the masses. Masses as an architectural form of expression will lose importance. The idea needs revision.

## PHILIP JOHNSON

. . . . . But nothing can equal aluminum for extrusion—that's been proven. Bronze does also extrude, but nowhere near to the capacity of aluminum. The limits to extrusion are not yet defined. They'll go on experimenting, as indeed they are, and extrusions will get larger and larger. There is a sharpness and a definition which, added to the lightness of the natural material, makes it perfectly natural for the outsides of buildings. Then you can include the window frame. If they ever get extrusions big enough to do the whole job, then aluminum will at last begin as a sheeting material for buildings.

. . . . . About the future of architecture. Of course,



*"I feel we are in one of the great golden ages of architecture."* PHILIP JOHNSON

I am very optimistic. I feel we are in one of the great golden ages of architecture. We are beginning to reach a wonderful style background in which to build and that's why you can talk in terms of the future. Imagine if we had to practice 75 years ago. I would have to invent a new style for every building I built.

For Richardson or Sullivan every building was a challenge! They had to start from nothing. Now I can use all Mies' work, all of Corbusier's work. All of the International Style, to use the phrase, is grist to our mill. For the first time since the Baroque synthesis of the Eighteenth Century, we have come to a period where we have a stylistic background that is part of our bloodstream on which we can start designing. Now I'm not telling you that architects have to go and do International Style work. Let them break away if they can. Let them try to bend the style which I am trying to do, which any architect worth his salt is trying to do.

## PIETRO BELLUSCHI

I would like to go back to perhaps thirteen or fourteen years ago when we architects were thinking of aluminum as an experimental material. I remember discussing the matter with Dr. Raver, who was the director of the Bonneville Administration which had just finished building the largest dam in the world and which had a contract to produce aluminum on the Columbia River.

Everbody was worrying about what would happen to such expensive plants after the war and how we could expand the use of aluminum. Everybody was thinking at the time perhaps of windows and screens and lighting fixtures, but I could see even then, along with many other architects, the possibilities of using aluminum for its lightness and its durability, lack of maintenance and other properties in all kinds of other ways, such as exterior facing of a building, and structural members.

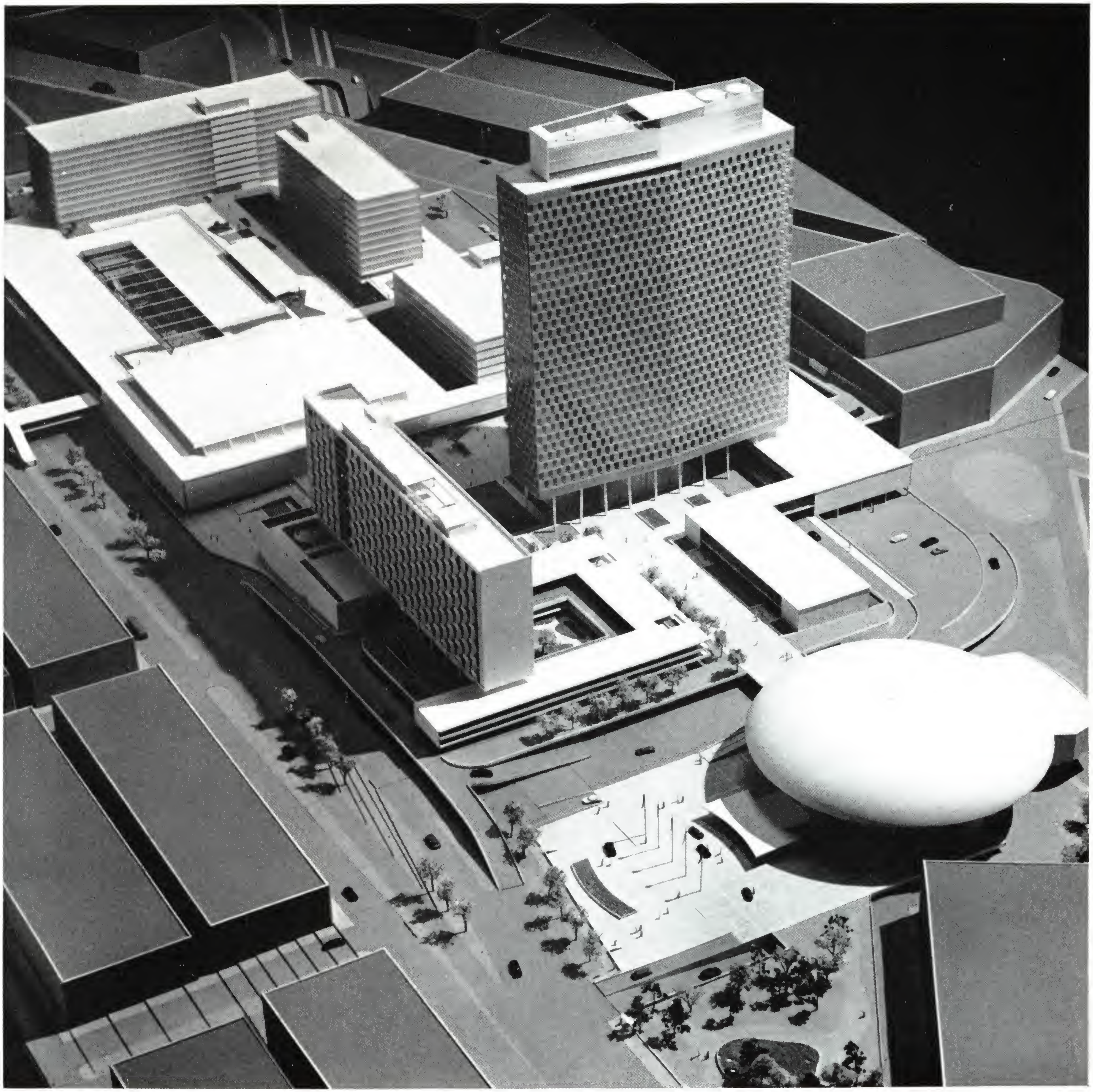
Of course, we are not yet using many structural members in aluminum but we will come to that the moment we find a way to circumvent the building codes which are very strict in regard to fire danger. Perhaps they're right in being firm. On the other hand, there are continuous developments which make some of their interpretations rather narrow and certainly stifling to the designer.

## ROBERT E. ALEXANDER

. . . . . I do recall that one of the main points I made out of our own experience in seven years on one school campus was that the best decision we had

*". . . we are not yet using structural members in aluminum but we will come to that . . ."* P. BELLUSCHI

*"An extrusion can be turned out in shapes which can be made to work for you."* ROBERT E. ALEXANDER



*Proposed Back Bay Center for Boston, Mass., by P. Belluschi, Architects Collaborative, W. F. Bogner, C. Koch & Assoc., H. Stubbins Jr.*

made in regard to maintenance in the early stages was to use unpainted aluminum for as many details as possible. This particular campus is within about five miles of the ocean so that we were very concerned at the beginning about the correct alloy to pick. We were put on the pan for hours by members of the building committee and also the Board of Trustees. Finally, in spite of the warnings that aluminum corroded as anything else corrodes, we took the best advice we could get and selected what we thought were the proper alloys. Our experience has been very good.

The client was very concerned within the first year. It had been predicted to us by all the literature that the aluminum, even the alloys we'd picked, would pit and show a little sign of corrosion in the early stages. Sure enough, we got a call from the client within the first year that the aluminum was all going to pieces. We went down ourselves. We even had representatives of the aluminum company involved make a survey and reassure the owner again just to wash the metal with soap and water and wait until the whole thing was pock-marked. Then it would look all right. Sure enough it's turned out to be gray all over and quite satisfactory. The owner swears by it now.

I should say, that if aluminum were used properly as it is in aircraft, we would first take advantage of the terrific asset offered by the fact that you can extrude aluminum. An extrusion can be turned out in a shape which can be made to work for you. That is, by developing re-entrant angles and grips in the design of the extrusion itself, if you understand the principles involved, you can actually develop details which not only have the shape that you want on the outside, but which actually can be attached without any bolts or nuts showing simply by snapping them on and off.

We used this principle in the Technology Building at Orange Coast College in the aluminum mullions, which not only clamped the windows in place but also the asbestos cement panels, yet were completely free of any nuts, bolts or screwheads on the outside. This type of design, I think, could find very wide application in building. Incidentally, in that particular case, I believe the cost of the die was only something like $250 on the whole job.

## EDGARDO CONTINI

. . . . . There is the drawback that aluminum is so easy to use that too little thought has been given to how it should be used properly. Because it is such a desirable material which can be worked so easily; because you can conceive so many shapes, since the cost of tooling and production of special shapes is very low, we often fail to get the best out of aluminum. This is, of course, true of most all new materials: generally what happens is that our techniques with new products improve so rapidly that we have no time to absorb and become aware of the full potential of the material.

. . . . . I think there is one building in my mind that has impressed me, both as a building *per se* and as to the use of aluminum in particular, and that is the Manufacturers Trust Bank in New York. The architect uses aluminum as the primary material in the skin though in limited quantity (the major extent being glass), but where he uses it, he uses it substantially. This was the first time that I saw aluminum really straight and elegant and giving the same feeling in contemporary architecture that the granite column used to give centuries ago—one of absolute stability, neatness, elegance and dignity.

Too often, however, aluminum has been used so cheaply and with so much intent on economy that it has failed to express its full potential for neatness

*". . . too little thought has been given to how it should be used properly."* EDGARDO CONTINI

of construction, proper detailing, straightforwardness and rigidity of expression.

In our Mid-Wilshire Medical Building, aluminum was used primarily for the louvering of the façade. In this building it is important to maintain good light control. Having full exposure to the south and west, the problem of light control became critical. It was handled by the use of vertical louvers on the western exposure and horizontal louvers on the southern exposure. It has proved very satisfactory from the standpoint of individual adjustment.

In one of our more recent projects, the new Tishman limit-height office buildings in Los Angeles, we are using aluminum on a much broader scale for light control by completely covering east and west façades with louvers and by protecting against southern sun with horizontal louvers on the south elevation. In this instance, the problem of maintenance and cleaning is also very significant; and from this standpoint also aluminum certainly has proven itself a very satisfactory material.

## I. M. PEI

I think the use of extrusions in aluminum will greatly expand. I also think that castings, which sound like a medieval material, will receive greater attention, especially those made with improved techniques. When you cast a piece of aluminum, to me it is more like a piece of stone. It is a material that will age with time. It has depth. Extrusions will not have that quality.

Architecture has already gone through a major revolutionary period. I think the future buildings—let's not call it the future of architecture—may not be unlike the buildings that are being built today. There certainly will be improvements in techniques, but the building itself, the exterior expression and the form of the building, may well be similar to the type of buildings we are now erecting. I don't think there will be too great a change for some time to come. We have a lot to digest and a lot to refine. However, I do expect greater richness. By that I do not mean lots of colors and a variety of forms, but there will be—refinement.

And then again I think there will be greater emphasis on planning. Its effect on architecture is obvious. My very limited experience has convinced



*" . . . castings, which sound like a medieval material, should very well receive greater attention."* I. M. PEI

me of this. Five or six years ago we were planning small buildings and one building at a time. Today 80% of the projects on our drafting boards involve a city block or many city blocks. This type of planning will not bear fruit for another five or ten years. I am sure that on many drafting boards throughout the country you will find a similar situation.

If we are fortunate enough to see such plans realized, modern cities will begin to show a certain "planned look" which is completely lacking today.

## MARIO CIAMPI

. . . I'm convinced in talking to other architects in various parts of the world that the time has come when there seems to be a reversion back to the basic concepts of what is structure. We look back at na-

*". . . we begin to see opportunities in architecture which are more daring . . . more exciting."* MARIO CIAMPI

ture and we see the uses of form, whether it's in the tree or leaf, or anything which is natural. It is something which we have come to appreciate and recognize. In my opinion it is the actual limit to which the use of form may be exploited.

In viewing and analyzing these basic forms which are existent in nature, we begin to see opportunities in architecture which are more daring, which are more exciting, and which more adequately meet human needs. At the same time, it can be done efficiently and economically.

I would say that the basic concept of this particular building* was predicated on the demands that were made on it. In this case, the structure happens to be a new high school which is going to be built here next year. The use of television and the use of visual aids and new concepts in educational training have placed demands on the architect which resulted in this solution, which is considered an unusual one today. It was only made possible through the ability of educators to recognize the need for this kind of education. The Board of Trustees and the people in the community had confidence in the architect and were willing to go along and allow him to implement these ideas. As a result, we feel we will have a good school. This building is not necessarily the effort of the architect, but the combined effort of all who represent it; that is, the educator, the architect . . . . along with the ability of the community to appreciate it.

A building doesn't have to be all aluminum just because you're going to use aluminum. But aluminum can find its proper place in the expression of building construction, depending on the human need which dictates the design of the building; also the concept of the architect and the emotional need that he feels is required of other materials to balance the use of aluminum.

*Westmoor High School, Daly City, Calif.

## CRAIG ELLWOOD

I believe that eventually the balloon frame, the conventional construction framing system used for residences, will disappear. Within the next ten or fifteen years all houses will be prefabricated, and will be developed around some sort of modular structural frame, with pre-built, pre-finished panels. This could be a big place for aluminum although there is an economic factor to consider. There would be a tremendous potential for aluminum in structural framework if aluminum shapes, like I-beams and H-columns can be developed. Because of its light weight, one man could erect and bolt a frame together, probably in a day or two.

I think that aluminum should express a metallic feeling. In my structures the color is governed by

*". . . one man could erect and bolt a frame together, probably in a day or two."* CRAIG ELLWOOD

the materials. I never paint brick, for example. I would much prefer to see the natural color of brick. I never paint wood. I don't even paint plaster or stucco. In my houses, I feel that the natural Sienna gray color of stucco is much nicer than any paint we could put on it and once you paint it, you have the maintenance problem.

## R. BUCKMINSTER FULLER

. . . . . What you are then prone to look upon, when you ask me about aluminum, is its unique behaviors, to which there is no competition whatsoever. These are the only real monopolies in the universe. Aluminum has certain true monopolies of behavior. I don't like the word "monopoly", however, because every element, even though it has unique behaviors, has those unique behaviors as part of a complex of behaviors, so there will also be associated behaviors.

No one behavior can be separated out or isolated or really monopolized. Therefore you will always have to take its preferential behaviors along with

its non-preferential behaviors. Good design science, then, finds out how to get the best combination in the inventory at the present moment and that's all your alloying strategy in essence. You're working for the progressively best associated complexes.

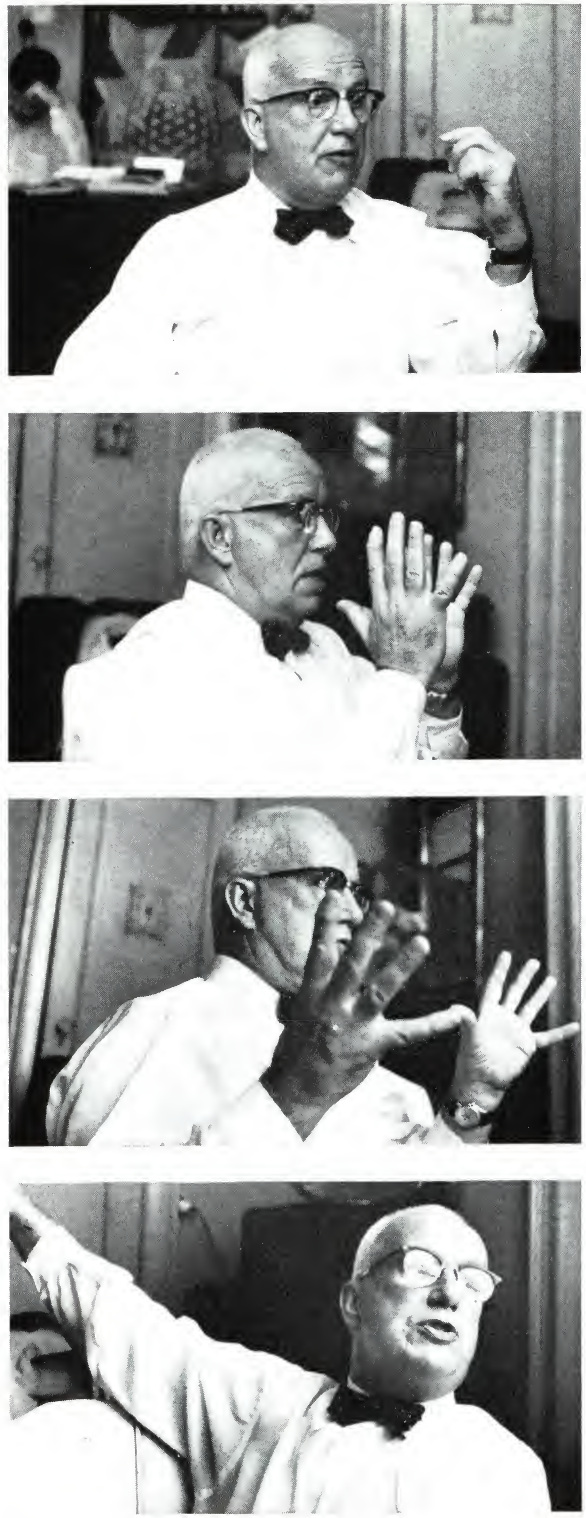
The augmentation in man's technical advantage over environment lies strictly in the history of the improvement of the tensile strength of the various alloys. The reason there was a Brooklyn Bridge at 1,595 feet versus a little chain link span in Germany of a few hundred feet was due to the development of alloys that went into piano and violin strings. That's all Roebling used . . . . piano wire. He caused high production of piano and violin strings.

Fifty years later, a 3500-foot Washington Bridge came because we had better alloy; we then go to 4200 for the Golden Gate Bridge. The inventory of tensile abilities has been so augmented that we're now ready to do a bridge twice the size of the Golden Gate. This is not that men are more daring, it is simply that there is higher ability in the material.

The future grows out of these augmented abilities. Alloys are the key to the future. Any forecast about aluminum, I would say, is going to depend entirely on the history of development of its augmented tensile abilities, its augmented alloying abilities, its associability with other chemical elements.

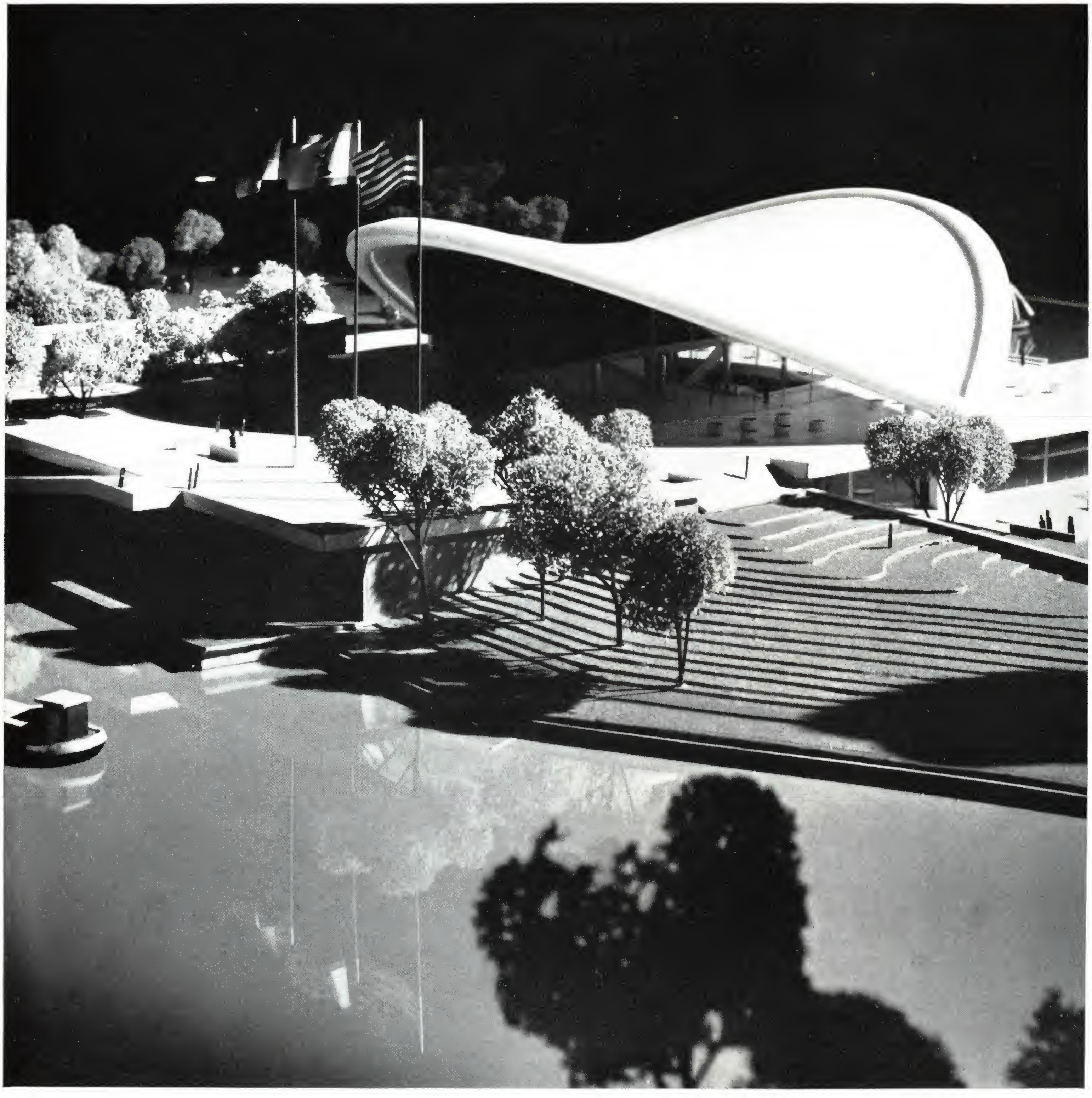
I have never had any patience with the concept of the all-concrete house, or the all-rubber aircraft or all anything else. The more successful the designers, the more they understand the complex abilities. A modern bomber aircraft has up to 60,000 types of parts, an automobile about 5,000 types of parts. The types of parts represent the essence of design science, which is to distinguish clearly the unique functions and to solve for each independently.

The way you can get such a light thing as an airplane is by defining each function independently, making each one efficient, then associating the functions. The reason the human being weighs so little and yet has all the extraordinary chemical departments is that each function is so uniquely solved. Then you have to associate the functions. The whole building world often seems to operate in the opposite direction.



*"Aluminum has certain true monopolies of behavior."*

R. BUCKMINSTER FULLER



238 *Design for conference hall, Berlin, Germany, by Hugh Stubbins & Associates, architects; Severud-Elstad-Krueger, structural engineers.*

## FRED SEVERUD

. . . . . Well, aluminum is a good medium to keep out the weather, and that means weather attacking a building both vertically and horizontally. I would say at the present that the best use of aluminum has been in these two functions, as roof and walls.

I can think of a good many other uses for aluminum in building, and particularly where a long expanse is required. Also the facility of shaping aluminum permits exposed structures which could be made very attractive. We have designed many schools using bar joists for instance. I am not too satisfied with their protectory appearance, but it's worked out reasonably well.

I can think of much better shapes—and they might be an excellent use for aluminum—where

*"If aluminum would be used in connection with hanging roofs . . ."* FRED SEVERUD

somewhat of a standard one-story school roof could be developed. Maybe also it could contain the complete frame. Not only would it be a bar joist member, but it would be a frame that would be exposed from the outside. Then it would form the roof and at the same time wind up as support for whatever kind of partition would fit in with a general scheme of that kind.

Aluminum might have many advantages there if it could be made part of the outside frame. We could then eliminate painting; and it would also integrate a structure.

The hanging roof has been greatly neglected. It is quite in line with our theme because here is one excellent use for aluminum. In addition to imitating the spider and its very delicate structure, full of finesse in the crossing cables, we add as little weight as we possibly can to preserve the airiness. It could be done with telling effect. But also, of course, it would cut down the weight and the cost. If aluminum would be used in connection with hanging roofs—we are trying it for one job on the boards now where the sheets are curved and the cross-cables give us tie-rods as part of the system—we can effect a roof with good functional characteristics and also be very dramatic. I feel that if this particular job works out in a practical way, it will be one of the best uses of aluminum at the present time.

## EDUARDO CATALANO

I feel that modern architecture is based upon a dynamic concept. It develops without preconceptions along with the inauguration of new ideas and progressive social structures. It will never reach a climax, because climax leads to decadence and death afterwards.

Architectural honesty is becoming more a slogan than a process. It is unfortunately the result of an intellectual attitude. True architectural honesty depends on the honesty of its social roots. At the present we are erroneously primarily concerned with its by-product: construction honesty. The

*"I feel that modern architecture is based upon a dynamic concept."* EDUARDO CATALANO

architects have established a set of "expression-honesty rules" that often are arbitrarily applied due to a false sense of values and intellectual speculation.

To expose the structure? A design is usually based upon a basic idea. If the exposure of the structure helps to express that idea, I agree it ought to be exposed. Sometimes there are other elements that perform that function more properly. In other examples the "structure" shown is not a structure at all. It is exposed to overcome the lack of a central idea.

But I insist; those things are irrevelant. We architects should be more concerned with the interpretation and development of our present social structure.

## CARL KOCH

. . . . . As architecture becomes an industrialized product, I think that aluminum has a larger place, for it is a material subject to industrialization itself. Its light weight is an increasingly important factor because of the handling involved in any industrialized product.

I think it is getting a start in office industrial types of construction more rapidly because the actual cost of the material isn't as large a factor in office or industrial construction. But I think that as soon as the home building industry becomes further industrialized and as aluminum becomes more adaptable to residential construction, it will play as big a part as it is already gaining in the other fields.

*"As architecture becomes an industrialized product, I think that aluminum has a larger place . . ."* CARL KOCH

Using Frank Lloyd Wright as the romance side of architecture, and Mies as the "simplicity out of chaos," as the other side of architecture . . . leaves us looking for humanity. I think perhaps it is the most important of the three sides, but I am really stumped trying to get a specific building as an illustration. I keep wandering around the City Hall in Stockholm. That's really a hodge-podge of all kinds of things, and perhaps that's one of the reasons I keep going back to it.

Certainly Scandanavian tradition and growth is, to me, a very important influence. I think they are the only people who are really practicing the precepts of democracy as it applies to architecture; and I have noticed through the years—it was 15 years ago the first time, and I have been back three or four times since—that somehow or other their buildings, as a group, seem to weather much better than ours. It's the only place I have noticed that the passage of that many years has done so little harm to the buildings . . . . . and it is so much more a part of the life of the people.

As I say, I haven't been able to put my finger on any one building or even one person or anything too specific. But let's look at the city of Stockholm. Here's a city which is alive today, which isn't depending on buildings of many, many years age. We always talk about the Piazzo in San Marco, but that's dead, as far as today is concerned. It was completed many years ago, and people are still using it, which is fine, but it isn't saying anything as far as what we are doing today.

But Stockholm is saying very effectively that democracy works and that the people are intelligent and do know what they want. It is saying that they are civilized. And today, there are darned few places in the world where you can, I think, get that feeling at all.

## WELTON BECKET

. . . . . I believe aluminum's greatest value at the present time is in its elimination of weight. It permits the architect to design with a more airy feeling and

gives him an opportunity to vary building faces and spandrels.

The development of many new materials is currently having an effect on new techniques and types of construction such as pre-stressed concrete, lift slab construction, precast and prefabricated materials for skins, spandrels and curtain walls. I think that the development of air conditioning—almost every building we do now is air conditioned—has changed the use of windows. The trend is going to be possibly away from so much windows due to the proper balance of light and air conditioning of the interior space. We have advocated in most of our buildings the block type of construction versus the wing type of building for offices.

*"It permits the architect to design with a more airy feeling . . ."* WELTON BECKET

In all our shopping centers we are trying to create a more leisurely way of shopping. The theory used to be that you'd lay out a store to make it as difficult as possible for the customer to find the elevators. Now we feel she should get to the escalator or elevator quickly and be able to go to the shoe section and out in a hurry. She should like a store, not get lost in it.

## L. L. RADO

I feel our biggest problem today is the creative use of our new materials . . . that applies to metals as well as to synthetic materials as opposed to natural materials. Stone and wood are close to nature, and their use is somehow governed by conserving the natural, inherent character of the material. There was a certain imperfection of natural materials that lent beauty and charm. Now with our new materials, it's perfection that is the feature and we don't somehow know as yet what to do with perfection and get a human result. It's a certain mechanical quality and exactness that can be very beautiful. But I think we still have a long way to go to reach that stage.

One aspect where modern architecture has not somehow grown up as yet applies to aluminum and other new materials . . . the aspect of aging gracefully. In the old masterpieces and even buildings that don't go back to say the Gothic or Baroque period, but say, only one hundred or two hundred years . . . there we see materials used that have aged and weathered without harm to their appearance. . . . On the contrary, aging has even enhanced their appearance.

With metals and synthetic materials, it is much more difficult. We have to find how to bring out that certain inherent quality of the material. Those are things that almost touch on the mysteries of nature. To penetrate those mysteries—what makes certain materials tick, what makes them look

*". . . a certain mechanical quality and exactness that can be very beautiful."* L. L. RADO

beautiful—it's not only their strength, it's not only their durability but also their appearance and maintenance. It seems that today's materials always have to be polished and maintained like a kitchen sink to be beautiful. And that, in a way, is not a natural thing. The old materials, like stone and wood, have a certain affinity with nature and nature wasn't fighting them. It appears to me that nature seems to fight our new materials. There isn't the same affinity with nature. I don't say that it cannot be done, but it will take time to discover how to find that harmonious relationship.

Those are things that cannot be done in the laboratory. I think we are doing very well these days with problems that can be proven in a lab or by some calculation or using Univac and so on. But when it comes to other problems, we are too impatient. It cannot be done overnight. It will take generations to develop the wisdom and understanding needed for a truly beautiful expression of these newer materials.

*"Buildings are no longer being built to last 500 years."*

GORDON BUNSHAFT

## GORDON BUNSHAFT

It seems to me that one of the great changes that has occurred in this country is that buildings are no longer being built to last 500 years. They are no longer erected like monuments where the interior uses are changed with each generation, as is the practice in many of the structures in Europe.

Today the economics of our civilization and the increasing requirements of technical developments necessary to provide the comforts demanded by our people, and real estate economic factors, are making non-institutional buildings obsolete in metropolitan areas in 25 to 40 years. This change, I think, is going to have a basic effect eventually on the design theories of contemporary architecture throughout all America.

I think the future of building in the United States is one of great activity. In other words, there will be great quantities of buildings erected in the near future. As to the quality of this work, I hope that we tend towards doing good buildings where each one is not an individualistic attempt at being different. I would rather see a street of neat, orderly structures rather than a street full of the products of 20th-Century "geniuses" creating a confused pattern.

When I was in Copenhagen about 20 years ago what struck me most was the fact that the contemporary buildings were not all different. They were unified and created, in the city, a nice pleasant vista. . . . . quiet, fresh and clean . . . very much like the people.

## PHILIP WILL, JR.

. . . . . First of all, I believe you must think of aluminum in rather new terms, that is, new methods of construction that are certainly not in common use at the present time. It would be a mistake, for instance, to try and use aluminum in the same structural shapes in which we now use steel. That would appear to me to be a misuse of aluminum. We see some indications in these very light space frames which appear to employ aluminum to its maximum capacity as a method of enclosing space and supporting that enclosure.

Aluminum poses a new set of problems. You begin to think of structures that take on something of the

*Headquarters for Reynolds Metals Company, Richmond, Va., by Skidmore, Owings & Merrill (William S. Brown, Gordon Bunshaft).*

*"You begin to think of structures that take on something of the nature of living plants."* PHILIP WILL, JR.

nature of living plants. They are not rigid, but they have within them a certain flexibility. They can move and weave. We can accept a certain amount of deflection which, in normal thinking, we avoid. It means that you would not combine, say, plaster with an aluminum structure, but you could employ other materials which of themselves can move and flex as aluminum itself does.

Of course, that's one of the important characteristics of an airplane. I see no reason why buildings have to be quite as rigid as they now make them. Sometimes there is greater strength in the reed that bends to the wind than there is in a very stiff structure which cannot resist the impact of strong forces and breaks.

*"... we could throw off the shackles of our thinking."*

PAUL WEIDLINGER

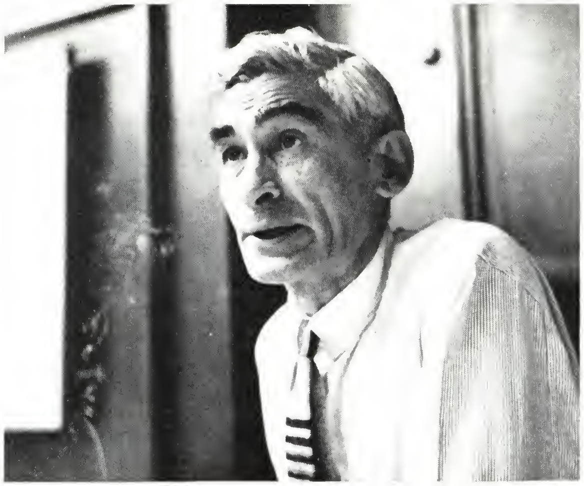
## PAUL WEIDLINGER

. . . . . I think that contemporary architecture has been set to a very great degree by use of our standard, modern materials like steel and reinforced concrete. Now when you consider a new material like aluminum, which is so different in many of its aspects, you find that the position for aluminum in architecture today is really not as important as is the position of steel and concrete. If one could visualize an architecture in which aluminum would obtain the importance and dominance that steel or reinforced concrete now has, then we would be talking about an architecture which we don't know but which we can only guess . . . . it's still too far in the future.

We are now using aluminum merely as a substitute. We haven't even begun to think about the potentialities of it because we are hampered in our thinking by other materials and many of these other materials now really sort of put the brakes on us. If we were to switch to entirely new materials, whether it is aluminum or some new kind of plastic or what have you, then we could throw off the shackles of our thinking. We could produce a contemporary architecture. It would be made by these new materials. I feel very strongly that this kind of development is in the air. I am convinced that technologically and economically it's possible and that it will come eventually.

## CHARLES GOODMAN

I was thinking of aluminum along the lines of what we call the opaque wall and transparent wall system of construction. We have been pioneering this system not only for large buildings but for domestic architecture. I have ceased to consider a wall as being something that you punch a hole into. It's a series of parts joined together. Those parts consist basically of two kinds, the opaque element and the transparent element, which allows you to have pri-



*"I have ceased to consider a wall as being something that you punch a hole into."* CHARLES GOODMAN

vacy where you want it and openness where you would prefer to have it.

That kind of thinking immediately moves you into preassembly. At the present time, in domestic architecture we are still using wood, which is heavy no matter how light we make our panels. I've got them down so light now that it is amazing. But if we were doing that same thing in aluminum, we would have panels that are far lighter. We would still have the quality that wood has always had for people, that is the sense of feel and touch, but I have reduced the amount of frame members to the minimum.

With glass, the only thing we're using the surround for is to hold the glass in place. I don't see any point to using wood for that surround. Why not use aluminum? Instead of having an aluminum window such as the kind we use at the present time, what you would have is a glass wall with aluminum as a unit or a transparent wall. As such I would say it has a tremendous future.

## RAPHAEL SORIANO

You must put yourself not in front of your work, you must be behind your work. You must listen to the materials. You must always respect what the materials have to say. You can not make a move in architecture, for example, in making a decision of integrating one element with another—without these two elements demanding certain things in their own relationship. You can't possibly inflict your own whims and say, "I want to put you two close together here because I think it's beautiful." That's the wrong way of talking. "I want to put the two together if they can perform together," is much better.

Decoration, an arbitrary part of esthetics, cannot be part of art. That's just a misconception. The so-called decorative applied art, or an art which is one man's opinion of esthetics, belongs to the medicine men. It doesn't belong to our era, because in our era we make use of science, consequently structure.

*"You must respect what the materials have to say."*

RAPHAEL SORIANO

## DONALD BARTHELME

. . . . . The aluminum was used for those items of metal exposed to the weather, of course, to avoid maintenance problems, painting and so forth. But there is another aspect about aluminum: it is a youthful metal and it serves to set a sprightly spirit throughout the building.*

But I think most of the reasoning behind the school* was more or less unconscious; it wasn't as

"*It is a youthful metal and it serves to set a sprightly spirit throughout the building.*" DONALD BARTHELME

defined then as it is now. I think it is perhaps better so, because the more defined it is, the more difficult your problem becomes. Primarily, of course, the effort was to not regard these children as particles of matter that needed to be assembled in certain groups and scheduled and timed and moved through the school in an orderly process the way a plant operates; there was something to be done with relationships between the children.

In other words, to teach these kids at the very beginning that always there exists some one else in the world with them; that the ultimate aim of the educational process is to teach them to get along with others. In the design of the various parts of the building it was necessary, or thought desirable, to accommodate certain utilitarian needs such as lighting, heating, enclosures, in such a way that there would be an advantage gained over and above these many physical things; that they would enjoy being in it; that it was beautiful to look at, as near as we could make it.

Of course, those things always have to be sought and fought for over and above the budget, because generally speaking we have no funds in the budget to acquire any intangible asset, and these satisfactions are intangible. For instance, when you sit in the building, or walk through it, you begin to sense a certain attitude, a certain lift, a certain excitement, a certain joy, that just exists throughout the thing. There is a pleasure in it.

** West Columbia Elementary School, Brazoria County Texas. See page 20 in this book.*

## EERO SAARINEN

The quickest first impression is the aluminum window, and one sees in it this whole development. The wooden window was replaced by the steel window. The steel window now has been replaced, or is well on its way to being replaced, by the aluminum window, and we can also frankly see some developments beyond that.

Let's try to think of the total building, in other words, architecture. While the wood window was replaced by the steel, the solid brick wall, with holes punched in it for windows, has really been replaced by the curtain wall.

Now, lets talk about the curtain wall separate from aluminum for a minute. I feel that the curtain wall is at this moment in about the same stage of development as Charles Lindbergh's plane, the *Spirit of St. Louis*. Planes had been built before that, from the Wright plane up. But, just at the time of the *Spirit of St. Louis* we did not know in which direction the airplane was going to go. I mean, in what direction formwise and technologically. Just a little later the hydroplane was a strong contender, but it has now passed out of existence. We find these

different developments at a certain formative stage and then one line gains a conviction. Now let's apply this to the curtain wall.

We have the curtain wall, for instance, that Wally Harrison is using in many of his buildings. There are the all-glass developments of Mies. Then there are the curtain walls that we have developed at General Motors. I believe the first panel of any kind was our really quite primitive attempt in this direction on the Drake University Science Building in Des Moines, Iowa.

Now depending upon the development of the curtain wall, aluminum will be used in one or another way, whether it is cast aluminum or stamped aluminum or extruded aluminum. The Research Building at General Motors has a wall development that I personally believe is the answer. It's an extruded aluminum frame which is about 12 feet high from floor level to floor level and about 10 feet wide. It is an aluminum extrusion that is put in place.

We have developed a method of rubber glazing with rubber extrusions. It is the same thing as was in buses, but for the first time developed in buildings. The thermopane as well as the wall panels are zipped into place, so that any time you can take these out and replace them if you wish.

In other words, here is the minor structural member being an aluminum extrusion. That has a great future which will probably last longer than aluminum in the window because this is more of a structural member.

. . . . . I think the big technical improvement which hasn't been felt yet but that is coming, is atomic energy. It will make heating of space so inexpensive that the problem of holding people within little cubicles against the elements will cease to exist. I could well imagine that with atomic energy, the logical way of building a shopping center, for instance, would be to have one great translucent dome over everything except the automobiles. It actually becomes an area of controlled climate.

Now that may well apply to all our pedestrian centers. The downtown areas of our cities might well be located under one of these domes, our shopping center, our places of assembly, restaurants and so forth. And, of course, that is going to change architecture completely.

*". . . I think the big technical improvement hasn't been felt yet . . ."* EERO SAARINEN

## MIES VAN DER ROHE

. . . . . But I think there are two ways to use a material. The one is to use it as a structure and the other is to use it just an as enclosure. The danger with aluminum is that you can do with it what you like; that it has no real limitations.

. . . . . I am working on architecture as a language and I think it has to have its grammar in order to have language. It has to be a living language but still you come in the end to the grammar. When you use it for normal purposes, you speak in prose. If you are good at that, you speak a wonderful prose; and if you are really good, you can be a poet. Yet it's the very same language.

I believe it is the same in architecture. If you have to construct something, you can make a garage out of it or you can make a cathedral out of it. The same means, the same structural methods you use for all these things. The structure is the basic grammar.

It has nothing to do with the shape whatever. But what I do, what you call my kind of architecture, we should just call a structural approach. We don't think about the form when we start. We think about the right way to use the materials. Collect the facts, all the facts as much as we can get. Study these facts. Then act accordingly and we accept the result.

Schroedinger, the physicist, talks about general principles and he says the creative vigor of a general principle depends precisely upon its generality. That is exactly what I think when I talk about the structure in architecture. It is not a special solution—it is a general idea. Sometimes people say "How do you feel when somebody copies you?" I say that is not a problem to me. I think that is the reason we are working, to find something that everybody can use. We hope only that he uses it right.

Thomas Aquinas says, "Reason is the first principle of all human work." Now, when you have grasped that once, you know, then you act accordingly. So I would throw everything out that is not reasonable. I think that it is human desire . . . to do something reasonable. Of course there will be certain climatic influences, but they will only color what is actually done.

I believe a much greater influence is that of science and technology. I see no difference if somebody does something reasonable in California or in the Mediterranean or in Norway. If they would do it with reason and not have ideas, particularly fancy architectural ideas, everything would be much better all the way around.

I don't want to be interesting . . . . I want to be good.

*"The structure is the basic grammar."*

*900 Esplanade Apartments, Chicago, Illinois, by Ludwig Mies van der Rohe.*

# INDEXES





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## INDEX OF ARCHITECTURE

## INDEX OF ALUMINUM PRODUCTS

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* Only items illustrated clearly in the photographs are indicated by page numbers.

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